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PATENT & TRADEMARK OFFICE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	09/531,531
Filing Date	03/21/2000
First Named Inventor	Yuichi Shirota, et al.
Group Art Unit	3743
Examiner Name	John K. Ford
Total Number of Pages in This Submission	Attorney Docket Number: 4041J-000452/COD

ENCLOSURES *(check all that apply)*

- ☒ Fee Transmittal Form
  - ☒ Fee Attached
- ☐ Amendment / Response
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Response to Missing Parts/ Incomplete Application
  - ☐ Response to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Assignment Papers *(for an Application)*
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) ____
- ☐ After Allowance Communication to Group
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☒ Appeal Communication to Group *(Appeal Notice, Brief, Reply Brief)*
- ☐ Proprietary Information
- ☐ Status Letter
- ☒ Other Enclosure(s) *(please identify below)*: **Return Receipt Postcard**

Remarks: **The Commissioner is hereby authorized to charge any additional fees that may be required under 37 CFR 1.16 or 1.17 to Deposit Account No. 08-0750. A duplicate copy of this sheet is enclosed.**

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Harness, Dickey & Pierce, P.L.C.	Attorney Name: Michael J. Schmidt	Reg. No. 34,007
Signature			
Date	December 12, 2003		

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☐ Applicant claims small entity status. See 37 CFR 1.27

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Complete if Known	
Application Number	09/531,531
Filing Date	03/21/2000
First Named Inventor	Yuichi Shirota, et al.
Examiner Name	John K. Ford
Art Unit	3743
Attorney Docket No.	4041J-000452/COD

METHOD OF PAYMENT (check all that apply)

☒ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

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Deposit Account Number: 08-0750

Deposit Account Name: Harness, Dickey & Pierce, P.L.C.

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FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filling fee	

SUBTOTAL (1) ($) 0

2. EXTRA CLAIM FEES

			Extra Claims		Fee from below		Fee Paid
Total Claims		-20 ** =	0	X		=	0
Independent Claims		-3 ** =	0	X		=	0
Multiple Dependent				X		=	0

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet.	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	330
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive – unavoidable	
1453	1,330	2453	665	Petition to revive – unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17 (q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR § 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR § 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 330

SUBMITTED BY

Complete *(if applicable)*

Name (Print/Type)	Michael J. Schmidt	*Registration No. Attorney/Agent*	34,007	*Telephone*	(248) 641-1600
Signature				*Date*	December 12, 2003

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#24
I Cooper
12/31/03

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Art Unit:	3743
Examiner:	John K. Ford
Appellant:	Yuichi Shirota, et al.
Serial No.:	09/531,531
Filed:	03/21/2000
For:	**Automotive Air Conditioner**
Atty. Docket:	4041J-000452/COD

APPEAL BRIEF

Appeal No. _____

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Director of the United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 on December 12, 2003.

By: _____
Michael J. Schmidt

Director of the United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is an appeal from the June 13, 2003 Final Rejection of Claims 6, 7, 9-12, 15-20, 22, 23 and 40-42 of the above referenced patent application. None of the claims have been allowed. Claims 1-5, 8, 13, 14, 21 and 24-39 were cancelled during the prosecution of the application.

Claims 6, 7, 9-12, 15-20, 22, 23 and 40-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combined teaching of JA 5-3365 (Fig. 5), JA 6-156049 and any one of

Stech, JP'388, JP 63-17107 (Mazda) or Newton (USP 2,728,206). Claims 6, 7, 9-12, 15-20, 22, 23 and 40-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over the prior art as applied to Claim 6 above and further in view of Nagao or JA 63-38016. Claim 6, 7, 9-12, 15-20, 22, 23 and 40-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over the prior art as applied to Claim 6 above, and further in view of Gebhardt or Marsteller or Brandecker or Bates or Mullin et al. The Claims on Appeal are Claims 6, 7, 9, 11, 12, 15-20, 22, 23, 40-42 and these claims are reproduced in Appendix A.

REAL PARTY IN INTEREST

DENSO Corporation is the real party in interest, being the assignee of the present application. The assignment was recorded on Reel 010649 at Frame 0339 on March 21, 2000.

RELATED APPEALS AND INTERFERENCES

To the best of Applicant's knowledge, no other appeals or interferences are pending which will directly affect, be directly affected by or have a bearing on the Board's decision in the present pending appeal.

STATUS OF CLAIMS

Claims 6, 7, 9-12, 15-20, 22, 23, 40-42, all of the pending claims in this application, stand finally rejected. Claims 1-5, 8, 13, 14, 21 and 24-39 were cancelled.

STATUS OF AMENDMENTS

No amendment was filed in response to the Final Office Action mailed June 13, 2003.

An Advisory Action was mailed by the Examiner on November 26, 2003 in response to Applicant's Notice of Appeal filed on October 17, 2003 (mailed October 13, 2003). No response was filed by the Applicant to the Advisory Action.

The Examiner in the Advisory Action stated that the "Applicant's Appeal is clearly premature given ongoing prosecution in Europe." Applicant is unaware of any requirement in the appeal process that relates to prosecution in Europe. The claims of this application were finally rejected in the Office Action mailed June 13, 2003. Pursuant to 37 CFR § 1.191(a), Applicant may appeal a final rejection by the Examiner.

SUMMARY OF THE INVENTION

Referring to Figure 2, the present invention is directed to an air conditioner for a vehicle. The air conditioner comprises a case forming an air passage. A cooling heat exchange 21 is disposed approximately horizontally in the case to define a lower space underneath the cooling heat exchanger. The cooling heat exchanger includes a plurality of tubes and corrugated fins and it is inclined at an inclination angle. A heating heat exchanger 22 is disposed in the case approximately horizontally at a position above the cooling heat exchanger. A blower 14 is disposed in the case offset from the cooling heat exchanger to blow air into the space underneath the cooling heat exchanger. The case defines an air introduction port through which the blower blows air into the space underneath the cooling heat exchanger. The air introduction port has a top end which is positioned above the or higher than the lower end of the cooling heat exchanger and a bottom end which is positioned under the upper end of the cooling heat exchanger in the vertical direction.

This construction causes the blown air to flow along the bottom surface of the cooling heat exchanger to promote the flow of condensation which occurs on the cooling heat exchanger.

Thus, the condensate flow down to the lower side of the cooling heat exchanger due to gravity and due to the flow of air coming from the blower.

ISSUE

Applicants present the following issues for review:

1. Whether or not Claims 6, 7, 9-12, 15-20, 22, 23, 40-42 are unpatentable under 35 USC §103(a) over the combined teaching of JA 5-3365 (Fig. 5), JA 6-156049 and any one of Stech, JP'388, JP 63-17107 (Mazda) or Newton (USP 2,728,206).
2. Whether Claims 6, 7, 9-12, 15-20, 22, 23, 40-42 are unpatentable under 35 USC §103(a) over Nagao or JA 63-38016.
3. Whether Claims 6, 7, 9-12, 15-20, 22, 23, 40-42 are unpatentable under 35 USC §103(a) over Gebhardt or Marsteller or Brandecker or Bates or Mullin et al.

A copy of these references including the translations provided to the Examiner are included in Appendix B.

GROUPING OF CLAIMS

Claims 6, 7, 9-12, 15-20, 22 and 23 stand or fall together as Group I. Claims 40-42 stand or fall together as Group II.

ARGUMENT

BACKGROUND OF THE INVENTION

The present invention is directed to an air conditioner for a vehicle which has the cooling heat exchanger disposed approximately horizontally in a case with the bottom surface of the cooling heat exchanger being slightly inclined relative to the horizontal surface. A heating heat

exchanger is also disposed approximately horizontally at a position above the cooling heat exchanger. Therefore, the two heat exchangers are stacked horizontally in an up-down direction. This arrangement allows for the reduction in the up-down dimension of the air conditioner.

A lower space is located underneath the cooling air conditioner and an air introduction port from which air blown by a blower is introduced into the lower space. The blower is offset to a side of the cooling heat exchanger and therefore air blown by the blower is introduced into the lower space through the air introduction port. This arrangement allows for a reduction in the dimension of the air conditioner in the front-rear direction when compared with an air condition case which locates the blower at a front or rear side of the cooling heat exchanger.

The cooling heat exchanger is defined as having a plurality of tubes and a plurality of corrugated fins. Thus, drain water (condensed water) readily moves to the bottom surface of the cooling heat exchanger. Further, because the cooling heat exchanger is inclined relative to the horizontal, the drain water moves to the lower end of the cooling heat exchanger due to gravity. The top end of the air induction port is located above the lower end of the cooling heat exchanger and the bottom end of the air induction port is located under the upper end of the cooling heat exchanger. Therefore, air blown by the blower flows along the bottom surface of the cooling heat exchanger to promote or push the drain water down to the lower end of the cooling heat exchanger to improve the draining performance.

As described above, the air conditioner of the present invention can be reduced in size in both the up-down and the front-rear direction and the draining of the condensed water can be improved.

JP 5-3365

The Examiner states that Figure 5 of JP 5-3365 shows the essential subject matter of Claim 6 with the exception of the details of the fin. However, JP 5-3365 does not disclose any

details of the heat exchanger. In the present invention, the cooling heat exchanger is defined, in Claims 6 and 40, as a corrugated fin type having a plurality of tubes and corrugated fins. This construction is not disclosed, taught or suggested by JP 5-3365. The Examiner continues to request a translation of JP 5-3365 after Applicant has provided translations of the relative portions of JP 5-3365 and Applicants believe they have complied with the Examiner's request for a translation.

Further, in Claim 6 and dependent Claim 42, the top end of the air introduction port is positioned above the lower end of the cooling heat exchanger and the bottom end of the air introduction port is positioned under the upper end of the cooling heat exchanger. When this was pointed out to the Examiner he simply stated that the bottom end of the air introduction port is clearly under the upper end of the cooling heat exchange. His comment regarding the top end of the air introduction port being above the lower end of the cooling heat exchanger was that JP 5-3365 shows the top end below the lower end which is directly opposite to the system defined in the claims.

Finally, JP 5-3365 does not disclose the mode switching member defined in Claim 6. The Examiner states that arguably elements 13 may not be "mode members" as called for in the claims and then he fails to provide where this limitation is in the prior art. In the discussion of JA 6-156049, he states that to have replaced elements 13 of JA'365 with the mode control doors of JA'049 to distribute air to vent, foot and defrost outlets to improve occupant comfort would have been obvious to one of ordinary skill in the art. What the Examiner has not done is that he has not explained the motivation to combine JA 6-156049 with JP 5-3365.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to

combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ 2d 1438 (Fed. Cir. 1991). See MPEP § 2143 - § 2143.03 for decisions pertinent to each of these criteria.

The initial burden is on the examiner to provide some suggestion of the desirability of doing what the inventor has done. "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references." *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985). See MPEP § 2144 - § 2144.09 for examples of reasoning supporting obviousness rejections.

When the motivation to combine the teachings of the references is not immediately apparent, it is the duty of the examiner to explain why the combination of the teachings is proper. *Ex parte Skinner*, 2 USPQ 2d 1788 (Bd. Pat. App. & Inter. 1986).

Regarding Claim 40, the Examiner did not present any discussion regarding the limitation of Claim 40 which states that the air blown by the blower flows along a substantial portion of the bottom surface of the cooling heat exchanger.

JA 6-156049

The Examiner states that JA'049 also shows the essential subject matter of Claim 6, but it also lacks a showing of fins on the evaporator. He further states that JA'049 appears to show the top end and bottom end of the air introduction port to be positioned as claimed. The Examiner even provided a marked-up drawing showing Figure 1 of JA'049.

The Examiner defines both the top end and the bottom end of the air introduction port as being located adjacent the upper end and the lower end of the cooling heat exchanger, respectively. The Examiner has to do this if there is any chance at meeting the claim limitations. The problem with this interpretation is that the Examiner has eliminated the limitation in the claim that the case defines a lower space in the case under a bottom surface of the cooling heat exchanger and the limitation that the air is blown through the air introduction port in the lower space. When the top and bottom end of the air introduction port are correctly identified such that a lower space is defined, the claim limitations are no longer met. The Examiner cannot interpret claim limitations two different ways in order to meet different claim limitations. The structure of JA 6-156049 is clearly different than what is claimed in Claim 6.

Regarding the fact that the claim defines the bottom end of the air introduction port as being under (and not below) the upper end of the cooling heat exchanger, the Examiner looks to Stech, JP 2-17388, JP 63-17107 or Newton. Again, what the Examiner has not done is that he has not explained the motivation to combine these references. As detailed above, there are three basic criteria which must be met and the Examiner has not met these three criteria.

Regarding Claim 40, the Examiner did not present any discussion regarding the limitation of Claim 40 which states that the air blown by the blower flows along a substantial portion of the bottom surface of the cooling heat exchanger. In addition, the claim limitations of Claim 42 which defines the top and bottom ends of the air induction port are not disclosed, taught or suggested by JA 6-156049 as detailed above.

JP 5-3365 (CONTINUED)

The Examiner then states that it would have been obvious to move the evaporator 6 of JP 5-3365 downward towards the bottom of the fan plenum so that the lowest point on the evaporator was below the highest point on the fan discharge aperture 23 to reduce the overall

height of the unit. While citing four references to be combined with JP 5-3365, the Examiner provided illustrations on how JP 63-17107 could be used as a teaching reference.

The JP 63-17107 reference does not include a heating heat exchanger and the evaporator 14 is disposed vertically not horizontally. In addition, JP 63-17107 is not interested in reducing the height of the unit since the unit sits on the floor of the car and blows air out from just under the windows as shown in Figure 1. Thus, one would not look to JP 63-17107 when attempting to solve the problem of the present invention in minimizing the up-down direction dimension and simultaneously improving the drainage of the condensed water. What the Examiner has done is that he has looked at Applicant's disclosure and then used this information to find isolated pieces of prior art and combine them using hind sight reconstruction.

In the case of *In re Horn*, 203 USPQ 969 (C.C.P.A. 1979), Judge Watson clearly articulated the well-known standard for combining references under 35 USC Section 103. Judge Watson stated that "...there must be some basis for concluding that the reference would be considered by one skilled in the particular art working on the pertinent problem to which the invention pertains". 203 USPQ at 971 (emphasis added).

The C.C.P.A. also addressed the required standards for combining references under Section 103 in the case of *In re Meng and Driessen*, 492 F.2d 834, 181 USPQ 94 (C.C.P.A. 1974). In the *Meng* case, Chief Judge Markey stated that although an invention may appear to be rendered obvious by a disclosure in the prior art reference, such a holding of obviousness is not proper when the disclosure occurs in a reference that is not directed toward the same problem as that addressed by the invention. Judge Markey further cautioned that the teachings or suggestions of such a reference must be evaluated without the use of hindsight gleaned from the applicant's disclosure, and thus must be viewed in a vacuum so far as the applicant's invention is concerned. 181 USPQ at 97.

Applicants submit that the proper test for evaluating prior art under 35 USC Section 103 is whether or not the prior art, either individually or taken together, can be seen as suggesting the Applicants' solution to the problem which the invention addresses. See: Rosemont, Inc. v. Beckman Instrument, Inc., 221 USPQ 1, 7, (Fed. Cir. 1984). The scope of pertinent prior art has been defined as that reasonably pertinent to the particular problem with which the inventor was involved. See: Lindemann Machinefabrik GMBH v. American Hoist and Derrick Co., 221 USPQ 481, 487 (Fed. Cir. 1984). Applicants assert that the use of hindsight in picking and choosing isolated elements from various pieces to the problems addressed by Applicants' invention is improper according to the above-discussed judicial standards governing the proper application of 35 USC Section 103.

In Stech, the cooling heat exchanger is arranged approximately vertically. Positioning of the heat exchanger in Stech horizontally goes against the teachings of Stech which is a slim-line van heater. Thus, similar to JP 63-17107 disclosed above, one would not look to Stech when attempting to solve the problem of the present invention in minimizing the up-down direction dimension while simultaneously improving the drainage of the condensed water without using hindsight which, as detailed above, is improper.

In JP 2-17388, there is no heating heat exchanger disclosed and the evaporator 100 is disposed more vertical than horizontal. Thus, one would not look to JP 2-17388 when attempting to solve the problem of the present invention in minimizing the up-down direction and simultaneously improving the drainage of the condensed water. Again, the Examiner has used hindsight to construct Applicant's invention which as detailed above is improper.

In Newton there is no heating heat exchanger and the blower is disposed below the cooling heat exchanger. Again, one would not look to Newton when attempting to solve the problem of the present invention in minimizing the up-down direction and simultaneously

improving the drainage of the condensed water. Without the use of hindsight which, as detailed above is improper.

What the Examiner has done is that he has looked at Applicant's disclosure and after failing to find a relevant piece of prior art, the Examiner used hindsight to pick and choose isolated elements from various pieces of prior art which bear little or no relationship to each other or to the problem addressed by the Applicant's invention in reconstructing the claimed invention from the Applicant's own disclosure.

In a decision of the C.A.F.C., Panduit Corp. v. Dennison Manufacturing Co., 810 F. 2d 1561, 1 USPQ 2d 1593 (Fed. Cir. 1987), Chief Judge Markey discussed and applied the various judicial pronouncements summarized above in reversing a lower court's holding of invalidity based on obviousness under Section 103, and further cautioned against the impermissible use of hindsight in picking and choosing isolated elements from various pieces of prior art, which bear little or no relationship to each other or to the problems addressed by the Applicants' invention, in reconstructing the claimed invention from the Applicants' own disclosure.

In the Panduit decision, chief Judge Markey offered the opinion that such impermissible hindsight reconstruction from isolated elements in a number of prior art references in order to arrive at the claimed combination is contrary to the purpose of the patent laws.

> "Virtually all inventions are necessarily combinations of old elements. The notion, therefore, that combination claims can be declared invalid merely upon finding similar elements in separate prior patents would necessarily destroy virtually all patents and cannot be the law under the statute, Section 103." 810 F. 2d at 1575, 1 USPQ 2d at 1603.

Furthermore, Judge Markey severely criticized the lower court for failing to view the claimed combination invention as a whole, but rather selecting bits and pieces from prior patents that might be modified to fit the lower court's interpretation of the claims.

Further, in the Panduit decision, Judge Markey discussed the fact that the large body of prior art, individual pieces of which show various bits and pieces of the claimed combination, can actually support a conclusion of non-obviousness, rather than serving as a basis for hindsight bit-by-bit reconstruction of the claimed invention.

> "Indeed, that the elements noted by the court lay about in the prior art available for years to all skilled workers, without, as the court found, suggesting anything like the claimed inventions, is itself evidence of non-obviousness. ...[The court] nowhere reconciled [its] evaluations with its contrary findings that no one skilled in the art had for years been led to those evaluations by the prior art." 810 F. 2d at 1577-78, 1 USPQ 2d at 1605.

Judge Markey's opinion also addressed the hindsight picking and choosing problem accordingly:

> "The district court nowhere pointed to anything in the prior art that would have suggested the desirability, and thus the obviousness, of making the distinctive structural elements and combinations...invented and claimed. Nor did the court succeed in the difficult task of casting its mind back into that of a person of ordinary skill in the art that had no pre-knowledge of the crucial structural differences that vitalize [the] inventions." 810 F. 2d at 1580, 1 USPQ 2d at 1606 (emphasis in the court's opinion).

In the present application, the cited references relate to problems that are quite distinct from the specific problems addressed by Applicants' claimed invention. Thus, it appears that at the time the invention was made, one skilled in the art would not have looked to these references in order to solve these problems, at least as these problems are addressed by Applicants' claimed invention.

In summary, the Examiner's primary references JA 5-3365 and JA 6-156049 fail to disclose the corrugated fin type of heat exchanger and the detailed positioning of the top and bottom end of the air introduction port in relation to the cooling heat exchanger. The Examiner's arguments related to these two references is inaccurate and the Examiner had to struggle to define Applicant's claimed elements in these two references. The Examiner then looks to Stech, JP'388, JP 63-17107 and Newton to support and modify his interpretation of the two primary references clearly using hindsight after reviewing Applicant's disclosure.

Regarding Claim 40, the Examiner has not applied any of the references to the limitations of this claim other than to include this claim in the general rejection.

Regarding the rejections based upon the addition of Nagao, JAG 3-38016, Gebhardt, Marsteller, Brandecker, Bates or Mullin et al., these rejections are all defined as "being unpatentable over the prior art as applied to Claim 6 above" and thus the above discussion regarding Claim 6 applies here also. Again, the Examiner has not discussed the relationship between the limitations of Claim 40 and the cited prior art.

Nagao, et al. discloses the blower arranged above the heating and cooling heat exchanges making it impossible to reduce the up-down direction of the unit. In addition, the relationship between the top and bottom end of the air introduction port in relation to the cooling heat exchanger is not possible.

JP 63-38016 discloses a vertically located heating heat exchanger located at the rear of the cooling heat exchanger and not above it as defined in Applicant's claims. In addition, the blower is located above the cooling heat exchanger making it impossible to have the defined relationship between the top and bottom end of the air introduction port and the cooling heat exchanger.

Gebhardt, Marsteller, Brandecker, Bates or Mullin et al. do not disclose a heating heat exchanger disposed above the cooling heat exchanger. None of these references disclose information that would supply the missing elements of the rejection of Claim 6 as detailed above.

CONCLUSION

Applicants respectfully submit that the Examiner has not shown that the various combinations of the references presents a prima facie case of obviousness as the references do not teach the elements of the claimed invention, much less suggest the combination of the

references. In fact, the references lack several features of the claimed invention and would not anticipate nor render the invention obvious to those skilled in the art.

Regarding Claim 40, none of the references were defined as meeting the limitations of Claim 40.

Applicant's invention provides the art with a unique construction that reduces packaging size and improves drainage which is neither suggested or disclosed by the prior art. Accordingly, reversal of the final rejection of Claims 6, 7, 9, 11, 12, 15-20, 22, 23, 40-42 is respectfully requested.

Respectfully requested,

HARNESS, DICKEY & PIERCE, P.L.C.

Date: December 12, 2003

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(248) 641-1600

Attachments: Appendix A – Claims on appeal
Appendix B – JP 5-3365; JP 6-156049; ***Stech*** (USP 4,842,046); JP 2-17388; JP 63-17107; ***Newton, et al.*** (USP 2,728,206); ***Nagao, et al*** (USP 4,696,340); JP 63-38016; ***Gebhardt, et al.*** (USP 2,703,223); ***Marsteller*** (USP 3,492,833); ***Brandecker*** (USP 2,552,396); ***Bates*** (USP 1,909,144); ***Mullin, et al.***(USP 3,000,192).

MJS/pmg

Appendix A

Claims 6, 7, 9, 11, 12, 15-20, 22, 23, 40-42 on appeal are as follows:

6. (on appeal) An air conditioner for a vehicle having a passenger compartment, said air conditioner comprising:

a case forming an air passage through which air is blown into the passenger compartment;

a blower for blowing air in said case into the passenger compartment;

a cooling heat exchanger for cooling air blown from said blower, said cooling heat exchanger being disposed approximately horizontally in said case to have a lower space in said case under a bottom surface of said cooling heat exchanger, the bottom surface being slightly inclined relative to a horizontal surface by an inclination angle;

a heating heat exchanger for heating air from said cooling heat exchanger so that the temperature of air to be blown into the passenger compartment is conditioned, said heating heat exchanger being disposed approximately horizontally at an upper side of said cooling heat exchanger; and

a mode switching member for selectively switching flow direction of the conditioned air blown into the passenger compartment, wherein

said cooling heat exchanger includes a plurality of tubes through which refrigerant flows, and a plurality of corrugated fins disposed between adjacent said tubes;

said blower is offset from said cooling heat exchanger to a side of said cooling heat exchanger;

said bottom surface of said cooling heat exchanger has a tilted upper end portion and a tilted lower end portion;

said case has a case portion defining an air introduction port from which air blown by said blower is introduced into said lower space, said air introduction port having a top end and a bottom end in a vertical direction; and

said top end of said air introduction port is positioned above said tilted lower end portion of said cooling heat exchanger, and said bottom end of said air introduction port is positioned under said tilted upper end portion of said cooling heat exchanger, in the vertical direction.

7. (on appeal) An air conditioner according to claim 6, wherein said blower and said cooling heat exchanger are disposed in such a manner that air is approximately horizontally blown from said blower toward said cooling heat exchanger, and

wherein air is introduced into said cooling heat exchanger from below the cooling heat exchanger.

9. (on appeal) An air conditioner according to claim 6, wherein said tubes extend in a direction approximately equal to a direction of air blown in said air-blowing passage from the blower to the cooling heat exchanger.

11. (on appeal) An air conditioner according to claim 6, wherein:

said case has a drain port for draining condensed water from said cooling heat exchanger to an outside of said case; and

said drain port is provided at a bottom-most portion of said case.

12. (on appeal) An air conditioner according to claim 6, wherein:

said case has a first opening for blowing air toward an upper side of the passenger compartment, a second opening for blowing air toward a lower side of the passenger compartment, and a third opening for blowing air toward a lower side of the passenger compartment, and a third opening for blowing air toward a windshield; and

said mode switching member is disposed at an upper side of said heating heat exchanger to selectively open and close said first opening, said second opening and said third opening.

15. (on appeal) An air conditioner according to claim 11, wherein said drain port is disposed below a downwardly inclined end of said cooling heat exchanger.

16. (on appeal) An air conditioner according to claim 6, wherein air is blown from said blower in an air-blowing passage between said blower and said cooling heat exchanger, said air-blowing passage between said blower and said cooling heat exchanger is approximately horizontal.

17. (on appeal) An air conditioner according to claim 6, wherein air is blown from said blower in an air-blowing passage between said blower and said cooling heat exchanger, and

said tubes and said corrugated fins extend in a direction approximately equal to a direction of air blown in said air-blowing passage from said blower to said cooling heat exchanger.

18. (on appeal) An air conditioner according to claim 6, wherein said blower is laterally spaced apart from said cooling heat exchanger.

19. (on appeal) An air conditioner according to claim 6, wherein said cooling heat exchanger includes a higher side and a lower side, and said blower includes a centrifugal fan;

wherein the centrifugal fan is offset from said cooling heat exchanger to the higher side of said cooling heat exchanger, and the centrifugal fan is laterally spaced apart from said higher side of said cooling heat exchanger such that the centrifugal fan and the cooling heat exchanger do not overlap in the vertical planes.

20. (on appeal) An air conditioner according to claim 19, wherein the centrifugal fan and the lower side of the cooling heat exchanger, respectively, are vertically offset a predetermined distance from said heating heat exchanger.

22. (on appeal) An air conditioner according to claim 6, wherein:

said blower includes a centrifugal fan including a top and a bottom; and

said tilted lower end portion of said cooling heat exchanger is positioned lower than said top of said centrifugal fan.

23. (on appeal) An air conditioner according to claim 6, wherein:

said case includes a scroll casing;

said blower includes a centrifugal fan disposed within said scroll casing; and

said scroll casing has a bell mouth shaped inlet disposed at the top of said scroll casing, from which air is drawn therein.

40. (on appeal) An air conditioner for a vehicle having a passenger compartment, said air conditioner comprising:

a case forming an air passage through which air is blown into the passenger compartment;

a blower for blowing air in said case into the passenger compartment;

a cooling heat exchanger for cooling air blown from said blower, said cooling heat exchanger being disposed in said case to have a lower space in said case under a bottom surface of said cooling heat exchanger; and

a heating heat exchanger for heating air from said cooling heat exchanger so that the temperature of air to be blown into the passenger compartment is conditioned, said heating heat exchanger being disposed approximately horizontally at an upper side of said cooling heat exchanger, wherein

said cooling heat exchanger includes a plurality of tubes arranged in a predetermined direction through which refrigerant flows, and a plurality of corrugated fins disposed between adjacent said tubes;

said blower is offset from said cooling heat exchanger to a side of said cooling heat exchanger;

said case has a case portion defining an air introduction port from which air blown by said blower is introduced into said lower space, said introduction port having a top end and a bottom end in a vertical direction;

said cooling heat exchanger is disposed such that air blown by said blower is introduced into said air introduction port and flows in said lower space along a substantial portion of the bottom surface of the cooling heat exchanger for promoting a flow of condensate in the predetermined direction of the plurality of tubes.

41. (on appeal) An air conditioner according to claim 40, wherein the cooling heat exchanger is slightly inclined relative to a horizontal surface by an inclination angle.

42. (on appeal) An air conditioner according to claim 41, wherein:

said bottom surface of said cooling heat exchanger has a tilted upper end portion and a tilted lower end portion; and

said top end of the air introduction port is positioned above said tilted lower end portion of said cooling heat exchanger, and said bottom end of said air introduction port is positioned under said tilted upper end portion of said cooling heat exchanger, in the vertical direction.

Appendix B

JP 5-3365

* Japanese Examined Utility Model Publication (JPY2) No. 5-3365

Air conditioning apparatus body 1 is formed longwise to form a space 2 for accommodating air conditioning device by surrounding metal plates and is based on a supporting base 3. In the space 2, a bypass passage 4 is formed beside a heater 5 using coolant in a vehicle. Below the heater 5, an evaporator 6 is disposed. In the bypass passage 4, an air mixing door 7 for adjusting temperature is disposed. The air mixing door 7 works together with a water valve (not shown) for controlling a supply of the coolant.

⑲日本国特許庁(JP) ⑪実用新案出願公告

⑫実用新案公報(Y2) 平5−3365

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B 60 H 1/00	102 Z	7914−3L	平成5年(1993)1月27日

(全6頁)

㊺考案の名称 車両用空調装置

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1

㊼実用新案登録請求の範囲

内部空間2に暖房用熱交換器5とその暖房用熱交換器の下方に冷房用熱交換器6を配すると共に、前記暖房用熱交換器5に流れる空気量を調節して温度調節する温度調節手段7とを備え、内部空間2の上方に吹出口13を下方に接続口14を設けた空調装置本体1と、

該空調装置本体1と別体に設けられ、内部空間18に送風機20を収納し前記接続口14と接続可能な吸入口22と吹出口23とが互いに対向する位置に形成された送風装置本体17と、

該送風装置本体17の吸入口22または吹出口23の何れか一方を前記空調装置本体1の接続口14に連結する連結手段24とを備え、

冷房時及び中間期には、前記送風装置本体17の吹出口23と前記空調装置本体1の接続口14とを接続し、下方の接続口14から内部空間2に導入された空気を上方の吹出口13から吹き出し、暖房時には、前記送風装置本体17の吸入口22を接続口14に接続し、前記上方の吹出口13から内部空間2に導入された空気を接続口14を介して下方の吹出口23より吹き出すことを特徴とする車両用空調装置。

考案の詳細な説明

(産業上の利用分野)

この考案は、車両特に建設車両用の空調装置に関する。

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(従来の技術)

従来、車両用空調装置にあつて、暖房用熱交換器と冷房用熱交換器とエアミックスドア等の温度調節手段を設けて、一つの遠心型の送風機を用いて温調された空気を常に上方の吹出口より吹出していた。したがつて、夏期等の冷房時または中間期の冷暖風を混合して吹出させる時には良いが、冬期等の暖房時には、頭熱足寒となり空調フィーリングが悪化していた。そして、送風機は小型で音響が少なく、同一風圧、同一風量、同一回転数に対し羽根車の直径が非常に小さくて済み、設備費、すえ付面積の節約ができるシロッコファン等の遠心送風機が用いられている。

(考案が解決しようとする問題点)

しかし、遠心送風機は、回転方向を選ぶために順方向回転と逆方向回転の切換回転ができなく、吹出方向は一方向であつた。これを解決するために、冷房専用、暖房専用の送風機を設けたものが実用化されているが、大型化にならざるを得ない欠点があつた。

そこで、この考案は、冷風の場合は上方の吹出が、暖風の場合は下方の吹出ができるようにしたことを目的とするものである。

(問題点を解決するための手段)

この考案の要旨は、内部空間2に暖房用熱交換器5とその暖房用熱交換器の下方に冷房用熱交換器6を配すると共に、前記暖房用熱交換器5に流

[illegible]を介して温度調節する温度調節手段[illegible]、内部空間2の上方に吹出口13を下方に接続口14を設けた空調装置本体1と、

該空調装置本体1と別体に設けられ、内部空間10に送風機20を収納し前記接続口14と接続可能な吸入口22と吹出口23とが互いに対向する位置に形成された送風装置本体17と、

該送風装置本体17の吸入口22または吹出口23の何れか一方を前記空調装置本体1の接続口14に連結する連結手段24とを備え、

冷房時及び中間期には、前記送風装置本体17の吹出口23と前記空調装置本体1の接続口14とを接続し、下方の接続口14から内部空間2に導入された空気を上方の吹出口13から吹き出し、暖房時には、前記送風装置本体17の吸入口22を接続口14に接続し、前記上方の吹出口13から内部空間2に導入された空気を接続口14を介して下方の吹出口23より吹き出すことを特徴とする。

（作用）

したがつて、冷風吹出しの場合には、空調装置本体の接続口に送風装置本体の吹出口を嵌入して上方の吹出口から上方吹出ができると共に、暖風吹出しの場合には、空調装置本体の接続口に送風装置本体の吸入口を嵌入して下方吹出ができるもので、前記目的を達成できるものである。

（実施例）

以下、この考案の実施例を図面により説明する。

図において、空調装置本体1は、金属板等で囲んで内部に空調機器を収納する空間2を有するように、ほぼ縦長に形成され、支持台3に固装されている。この空調装置本体1の空間2内には、上方にバイパス通路4を残して軍両の冷却水による暖房用熱交換器5が、そして、その下方に冷房サイクルを構成するエバポレータの冷房用熱交換器6がそれぞれ配され、該バイパス通路4には、温度調節手段となるエアミックスドア7が配されている。このエアミックスドア7は、暖房用熱交換器5に冷却水の供給を制御する温水弁（図示せず）と連動して動かされる。

空調装置本体1の上方には、水平面8と傾斜面9とを有し、水平面8には、下記する送風機20の風量をOFFから徐々に増大するように調整する送風量コントロールスイッチ10、前記冷房用熱交換器6の能力を制御するサーモコントロールスイッチ11及び前記エアミックスドア7を制御する温度コントロールレバー12を有しており、サーモコントロールスイッチ11は冷房サイクルOFF接点と、それに続いて冷房サイクルを構成するコンプレッサのON－OFF温度制御接点とを有し、温度コントロールレバー12を動かすことで冷風と暖風との混合比が変化される。傾斜面9には、上方の吹出口13が設けられ、その方向を適宜に変化できる構成となつている。

空調装置本体1の下方には、その前面側に横方向に長い接続口14が形成され、該接続口14は前記した冷房用熱交換器6の下方の空間に接続されている。この接続口14には下記する送風装置本体17の吸入口22又は吹出口23が嵌入されて接続される。

送風装置本体17は、金属板等で囲んで内部に送風機20等を収納する空間18を有するように横長に形成されている。

送風装置本体17の内部には、スクロール19、その内部に配される遠心型の送風機20及びその送風機20を回転させるモータ21を有し、その外側に長手方向に吸入口22とこれに対向する側に吹出口23とを突出して形成している。この吸入口22と吹出口23は共に同じ形状で、前記空調装置本体1の接続口14内に嵌込める形状となつている。

吸入口22は送風機20の吸込み側に連通され、吹出口23は送風機20の吹出し側に連通されている。したがつて、送風機20が第2図矢印方向に回転すると、吸入口22から空気を吸入し、吹出口23から空気を吹出させることになる。

この送風装置本体17は前記支持台3上に載置され、しかる後に送風装置本体17と空調装置本体1とを連結手段24にて結合する。連結手段24はこの実施例では一方にフック部24aを固着し、他にバックル部24bを設けた構成であるが、この連結手段に限定するものではない。

上述の構成において、冬期等における暖房時には、まず送風装置本体17の吸入口22を空調装置本体1の接続口14内に嵌入し、連結手段24にて固定する。即ち第2図に示すようにし、しか

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6

暖房時に、温度コントロールレバー12をHOT側に切換えて、送風量コントロールスイッチ10をOFFから適宜な送風量に切換える。これにより、車室内空気は上方の吹出口13を介して吸込まれ、暖房用熱交換器5にて温められ、不作動の冷房用熱交換器6を介して送風機20を通り吹出口23から車室内の足元付近に吹出される。

冷房や、中間期にあつては、まず送風装置本体17が第2図のような状態にある場合には、該本体17を取り外して、第5図に示すように空調装置本体1の接続口14に該送風装置本体17の吹出口23を嵌入し、今までと逆に連結する。

しかる後に、温度コントロールレバー12をCOLD側に切換え、サーモコントロールスイッチ11をOFFから適宜な位置に切換え、送風量コントロールスイッチ10をOFFから適宜な送風量へ切換える。これにより送風装置本体17の吸入口22から車室内の下方の空気を吸込み、該送風装置本体17の吹出口23から空調装置本体1へ送られ、冷房用熱交換器6にて冷風となり、必要により動かされている暖房用熱交換器5を介して上方の吹出口13から車室内の上方に向けて冷風が吹出されるものである。

なお、中間期に吹出温度をそれほど下げないようにするためには、温度コントロールレバー12をHOT側に適宜量移動すれば暖房用熱交換器5にエンジンの冷却水が導びかれると共に、エアミックスドア7で該暖房用熱交換器5を通す量が制御されて冷風が適宜再加熱されるものである。

（考案の効果）

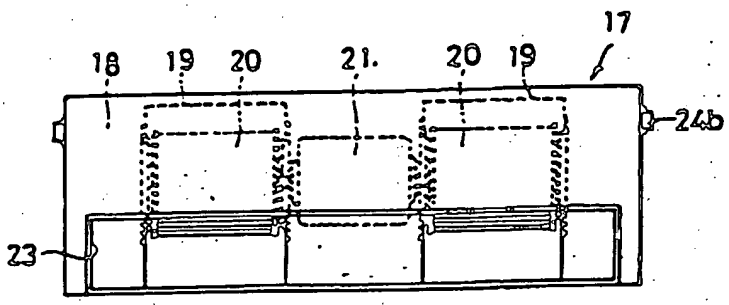
以上のように、この考案によれば、送風装置本体の空調装置本体への接続方向を変えることにより、冷房時には上方吹出を、暖房時には下方吹出を得ることができて、空調装置の基本である頭寒足熱を発揮でき、空調フィーリングを向上させることができる。

図面の簡単な説明

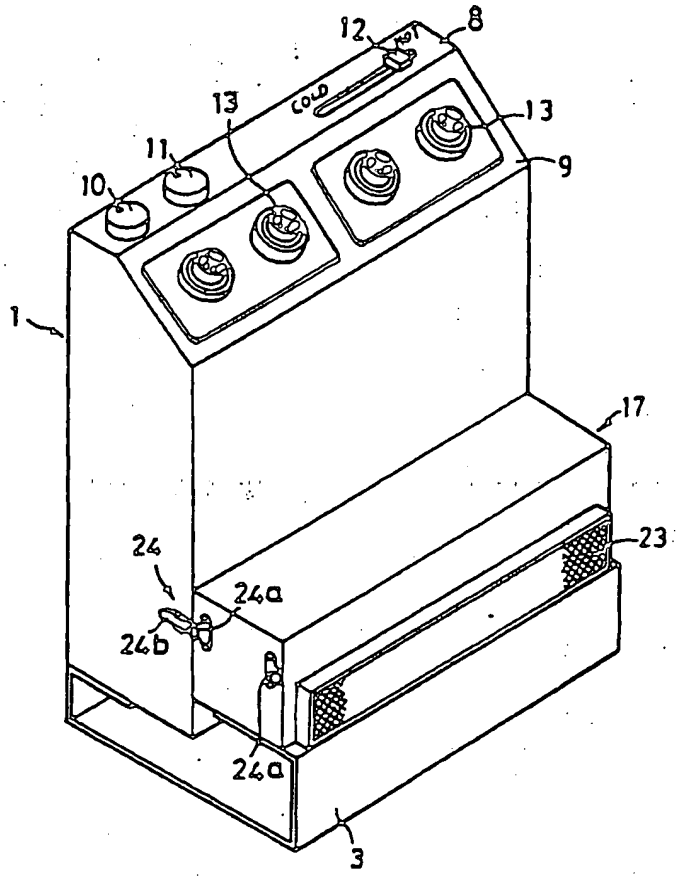
第1図はこの考案の実施例を示す斜視図、第2図は同上の断面図、第3図は空調装置本体から送風装置本体を外した状態の斜視図、第4図は送風装置本体の吹出口方向から見た図、第5図は冷房時における吹出状態を示す断面図である。

1……空調装置本体、5……暖房用熱交換器、6……冷房用熱交換器、7……温度調節手段、13……上方の吹出口、14……接続口、17……送風装置本体、20……送風機、22……吸入口、23……吹出口。

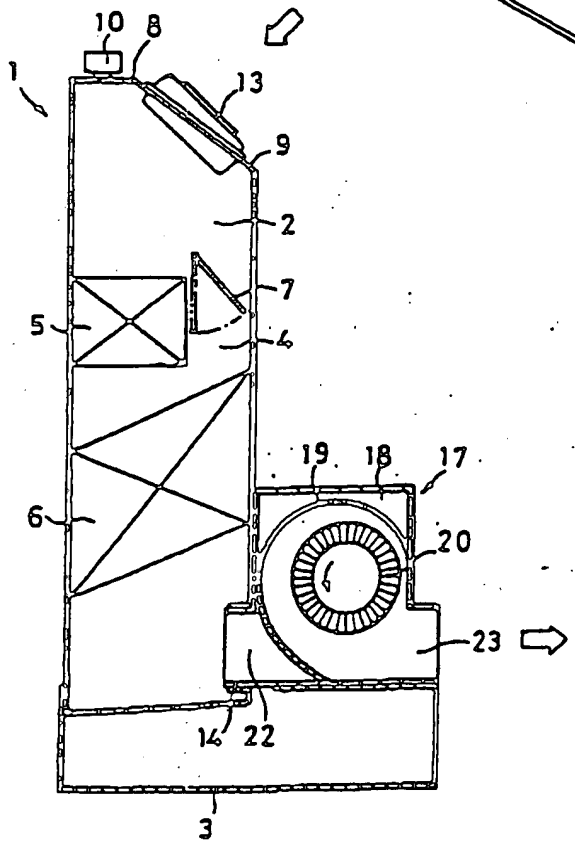
第4図



第1図


12
8
13
HOT
COLD
13
11
9
10
1
17
23
24
24a
24b
24a
3

第2図


10
8
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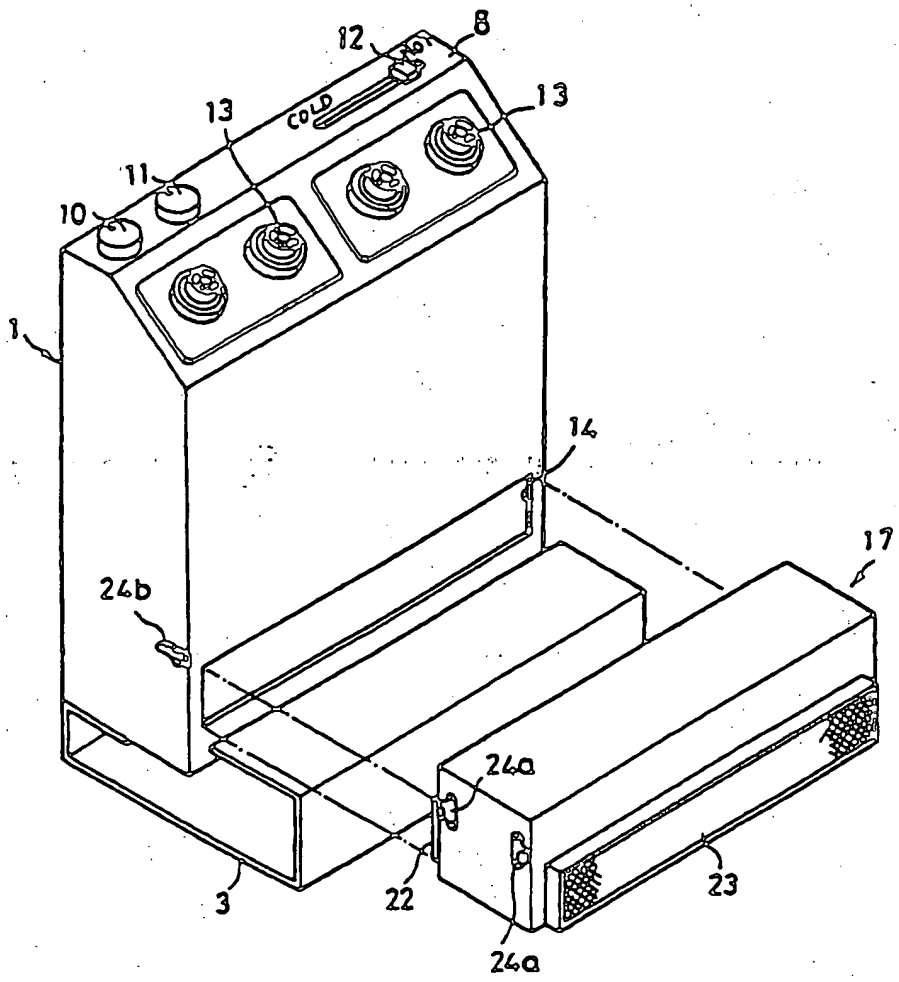
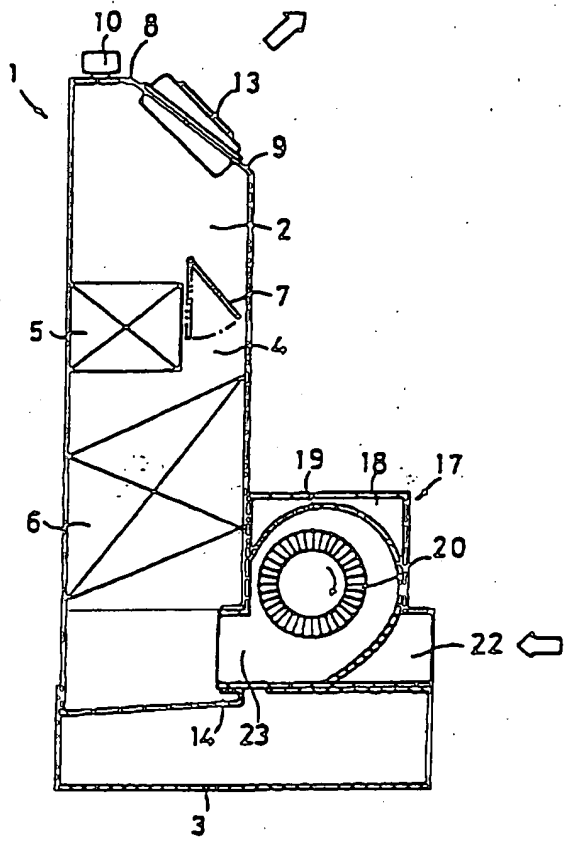
13
9
2
7
5
4
19
18
17
6
20
23
14
22
3

第3図



第5図



JP-Y2-5-3365

(page 2 column 3 line 30 - 41)

An air conditioning unit body 1 is formed longwise to form a space 2 for accommodating an air conditioning device by surrounding metal plates and is based on a supporting base 3. In the space 2, a bypass passage 4 is formed beside a heater 5 using coolant in a vehicle. Below the heater 5, an evaporator 6 is disposed. In the bypass passage 4, an air mixing door 7 for adjusting temperature is disposed. The air mixing door 7 operates together with a water valve (not shown) for controlling a supply of the coolant.

(page 2 column 4 line 21 - 28)

A blower unit body 17 has a scroll 19, a centrifugal type blower 20 disposed in the scroll 19, and a motor 21 for driving the blower 20 disposed in the scroll 19, inside itself. Outside the scroll 19, the blower unit body 17 has a suction port 22 and an air-blowing port 23, which respectively protrude and are opposite to each other in a longitudinal direction. The suction port 22 and the blower port 23 have the same shape, and can be attached into a connection port 14 of the air conditioning unit body 1.

(page 2 column 4 line 41 - page 3 column 5 line 24)

In the above-described construction, at a heating time in winter or the like, the suction port 22 of the blower unit body 17 is attached into the connection port 14 of the air conditioning unit body 1, and is fixed thereto by connection means 24. As shown in FIG. 2, thereafter, a temperature control lever 12 is switched to

a HOT position, and an air-flow-amount control switch 10 is switched from an OFF position to a position of a suitable air flow amount. Thereby, air inside a passenger compartment is sucked through an upper blower port 13, and is heated by a heating heat exchanger 5. Then, the heated air passes through the blower 20 via a cooling heat exchanger 6 not operating, and is blown toward feet of a passenger through the blower port 23.

At a cooling time in summer or in a middle season, when the blower unit body 17 is under a state shown in FIG. 2, the blower unit body 17 is removed, and the blower port 23 of the blower unit body 17 is attached into the connection port 14 of the air conditioning unit body 1.

Thereafter, the temperature control lever 12 is switched to a COLD position, a thermal control switch 11 is switched from an OFF position to a suitable position, and the air-flow-amount control switch 10 is switched from an OFF position to a position of a suitable air flow amount. Thereby, air at a lower side inside the passenger compartment is sucked from the suction port 22 of the blower unit body 17, and is sent from the blower port 23 of the blower unit body 17 into the air conditioning unit body 1. Then, the air is cooled by the cooling heat exchanger 6, and the cooled air is blown from the upper blower port 13 to an upper portion in the compartment through the heating heat exchanger 5 which is operated when necessary.

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An air conditioner includes an evaporator (28) disposed at an upper side of a blower (18), and a radiator (46) disposed at an upper side of the evaporator (28). On an upper side of the radiator (46), there are formed a defroster air outlet (50), a foot air outlet (54), an upper side air outlets (58, 60) and switching doors (52, 56, 62). In the air conditioner, the evaporator (28) is disposed approximately horizontally, and a drain pipe (68) for draining condensed water is provided at a lower side position of the evaporator (28).

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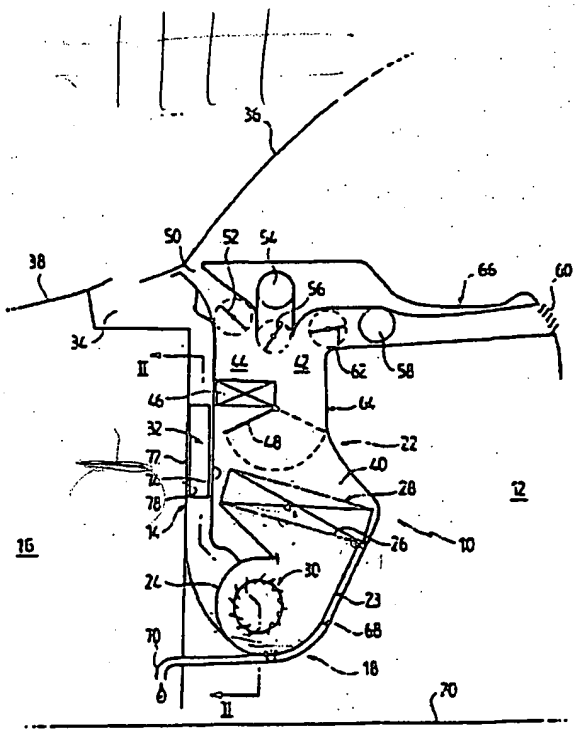
(54)【発明の名称】　自動車の車室用の暖房・換気・空調装置

(57)【要約】
【目的】　車室内の占有容積が小さく、右ハンドル式、左ハンドル式のどちらの自動車にも設置できる暖房・換気・空調装置を提供する。
【構成】　ブロワ１８と空気分配器２２とを、ブロワ１８を下にして垂直に配置して、車室１２の前面の計器板６６の下方に取付け、車室１２とエンジン室１６とを隔てる分離隔壁１４と空気分配器２２との間に、車幅方向に扁平な外気吸入管３２を設けて、外気をブロワ１８で吸引して、空調用の蒸発器２８や暖房用の熱交換器４４などを経て、空気分配器２２により、吹出し口５０、５４，５８，６０から車内へ送り出す。装置全体が垂直型であるため、車室内の占有容積が少なく、エンジン室にはみだすこともない。左右対称であるため、ハンドルが左右いずれの形式の自動車にも、改造なしで設置できる。



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【特許請求の範囲】

【請求項1】　空気の吸入口(24)と吐出口(26)とを備えるブロワ(18)と、ブロワ(18)の吐出口(26)に接続された空気取入れ口(40)を有し、それに装着した熱交換器(46)を通して、空気吹出し口(50)(54)(58)(60)から、車室内の各部に冷風又は温風を送りこむ分配器(22)とを備える自動車の車室用の暖房・換気・空調装置において、

ブロワ(18)を分配器(22)の下方として垂直に配置し、ほぼ垂直を向く空気吸入管(32)の上端を外気吸入孔に、同じく下端をブロワ(18)の吸入口(24)にそれぞれ接続し、かつ外気吸入管(32)を、自動車の車室(12)とエンジン室(16)とを隔てるほぼ垂直の分離隔壁(14)と空気分配器(22)との間に配設したことを特徴とする自動車の車室用の暖房・換気・空調装置。

【請求項2】　外気吸入管(32)は、少なくとも分配器(22)の全高を超えるところまで延びていることを特徴とする請求項1に記載の自動車の車室用の暖房・換気・空調装置。

【請求項3】　外気吸入管(32)は、少なくともブロワ(18)の上部より高所まで延びていることを特徴とする請求項1又は2に記載の自動車の車室用の暖房・換気・空調装置。

【請求項4】　外気吸入管(32)は、自動車の上下方向の寸法が小さく、車幅方向の寸法が大きい、車幅方向に細長い断面形を有することを特徴とする請求項1ないし3のいずれかに記載の自動車の車室用の暖房・換気・空調装置。

【請求項5】　外気吸入管(32)は、車室(12)内部に連通する少なくとも1個の循環空気取入れ口(78)を備え、かつ、循環空気の吸入を止めて、車体外からの新鮮な空気をブロワ(18)に吸気させる閉止位置と、車室から循環する空気をブロワ(18)に吸気させる開放位置とに移動可能な制御弁(80)を備えることを特徴とする請求項1ないし4のいずれかに記載の自動車の車室用の暖房・換気・空調装置。

【請求項6】　ブロワ(18)は、それぞれ2か所の吸引口(90)(92)を通して空気を吸引する2個のファン(84)を備え、かつこれら2個のファンを共通の1個のモーター(88)で駆動するようにしてあることを特徴とする請求項1ないし5のいずれかに記載の自動車の車室用の暖房・換気・空調装置。

【請求項7】　ブロワ(18)の吐出口(26)を、上向きに、また分配器(22)の空気取入れ口(40)を下向きとしてあることを特徴とする請求項1ないし6のいずれかに記載の自動車の車室用の暖房・換気・空調装置。

【請求項8】　ブロワ(18)の吐出口(26)と分配器(22)の空気取入れ口(40)との間に蒸発器(28)を設けて、空調された空気を分配器(22)に送り込むようにし、かつ、蒸発器(28)からの凝集水分を排出するために、蒸発器と連通され、かつブロワ(18)に沿って下方を向く排出管(68)を設けたことを特徴とする請求項1ないし7のいずれかに記載の自動車の車室用の暖房・換気・空調装置。

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【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、自動車の車室用の暖房・換気・空調装置に関する。

【0002】

【従来の技術】この種の装置としては、空気の吸入口及び吐出口を有するブロワと、ブロワの吐出口に接続された、もう1つの吸入口を有する分配器とを備え、かつこの分配器に吸入された空気を加熱する熱交換器と、冷却又は加熱された空気を自動車の車室の各部に送風する空気吹出し口を備える装置が知られている。

【0003】このような公知のものでは、車室の外から吸入された空気を、ブロワによって圧縮して分配器に送りこみ、必要に応じて加熱した後、適宜の制御用フラップ弁により調節して、吹出し口から車室内に送風する。

【0004】この種の公知の装置では、ブロワの空気吸入口は、一般に、エンジン室を覆うフードの上部で風防窓の下端部に配置された、空気吸入口又は空気取入れ孔に近接した位置に設けられている。

【0005】分配器は、ブロワの直後に設けられ、装置は、全体としてほぼ水平に配置されている。

【0006】

【発明が解決しようとする課題】上記公知の装置は、ほぼ水平に配置された構成であるために、計器板の車室側の下方、あるいはエンジン室の中のいずれに設置しても、占有容積が大きくなっている。

【0007】また、非対称的な右ハンドル式と左ハンドル式の自動車に適用する装置を、別々に設計する必要が生じ、製造コストに影響している。

【0008】さらに、この公知の装置は、一般的にきわめて手がとどきにくいため、保守や修理の作業が必要になったときに、不便である。

【0009】さらにこの公知の装置では、ブロワの吸入口を車室に連通させて、車室内の空気を循環させ、この吸入口を、フラップ弁によって閉じると、ブロワが、外部の新鮮な空気を吸引するようになっている。

【0010】この公知の装置は、寸法上の制約があるため、空気吸入口により、ブロワの正常な作動を妨げられることがある。

【0011】本発明の主目的は、上記の欠点を解消した、自動車の車室用の暖房・換気・空調装置を提供することである。

【0012】本発明の別の目的は、自動車の車室内における占有容積が小さい上記装置を提供することである。

【0013】本発明のさらに別の目的は、自動車が右ハンドル型であっても左ハンドル型であっても、取付けることができる上記装置を提供することである。

【0014】本発明のさらに別の目的は、エンジン室内

に、全くはみださない上記装置を提供することである。

【0015】本発明のさらに別の目的は、循環空気の吸入口によって、ブロワの作動が妨げられることがない上記装置を提供することである。

【0016】

【課題を解決するための手段】上記の目的を達成するために、本発明は、次のとおりに構成されている。

【0017】空気の吸入口と吐出口とを備えるブロワと、ブロワの吐出口に接続された空気取入れ口を有し、それに装着した熱交換器を通して、空気吹出し口から、車室内の各部に冷風又は温風を送りこむ分配器とを備える自動車の車室用の暖房・換気・空調装置において、ブロワを分配器の下方として垂直に配置し、ほぼ垂直を向く空気吸入管の上端を外気吸入孔に、同じく下端をブロワの吸入口にそれぞれ接続し、かつ外気吸入管を、自動車の車室とエンジン室とを隔てるほぼ垂直の分離隔壁と空気分配器との間に配設したことを特徴とする自動車の車室用の暖房・換気・空調装置。

【0018】外気吸入管は、少なくとも空気分配器の全高を超えるところまで延びていることが望ましい。

【0019】外気吸入管は、少なくともブロワの上部より高所まで延びていることが望ましい。

【0020】外気吸入管は、自動車の上下方向の寸法が小さく、車幅方向の寸法が大きい、車幅方向に細長い断面形を有することが望ましい。

【0021】外気吸入管は、車室内部に連通する少なくとも1個の循環空気取入れ口を備え、かつ、循環空気の吸入を止めて、車体外からの新鮮な空気をブロワに吸気させる閉止位置と、車室から循環する空気をブロワに吸気させる開放位置とに移動可能な制御弁を備えることが望ましい。

【0022】ブロワは、それぞれ2か所の吸引口を通して空気を吸引する2個のファンを備え、かつこれら2個のファンを共通の1個のモーターで駆動するようにしてあることが望ましい。

【0023】ブロワの吐出口を、上向きに、また分配器の空気取入れ口を下向きとしてあることが望ましい。

【0024】ブロワの吐出口と分配器の空気取入れ口との間に蒸発器を設けて、空調された空気を分配器に送り込むようにし、かつ、蒸発器からの凝集水分を排出するために、蒸発器と連通され、かつブロワに沿って下方を向く排出管を設けることが望ましい。

【0025】

【作用】従来の水平型と異なり、垂直方向に構成してあるため、自動車の車体内の占有容積は減少し、運転席と計器板との間に設置できる。

【0026】垂直方向を向く外気吸入管を、風防窓の下部に近い外気吸入孔と、装置の下部に設置したブロワの吸入口との間に接続して、新鮮な外気を取り入れる。

【0027】ブロワの吸入側管路に設置した制御弁により、ブロワに吸引される空気を、新鮮な外気と車室からの循環空気とに切り替える。

【0028】

【実施例】図1は、自動車に取付けた本発明の装置を、自動車の前後方向に切断した概略断面図、図2は、図1のII－II線における断面図である。

【0029】図1は、自動車の車室(12)用の暖房・換気・空調装置(10)を示す。この装置(10)は、自動車の車室(12)とエンジン室(16)とを隔てる垂直な分離隔壁(14)の車室側に取付けられている。防火壁を兼ねる分離隔壁(14)は、自動車の前後方向に対して横断方向を向いている。

【0030】装置(10)は、分離隔壁(14)に垂直方向に装着してあり、必須の物として、自動車の床(20)に近い所に位置する空気ブロワ(18)を備えている。空気ブロワ(18)は、空気分配器(22)の直下方に位置している。

【0031】空気ブロワ(18)のケース(23)は、渦巻形に形成され、分離隔壁(14)斜め上方を向く空気吸入口(24)と、蒸発器(28)を取付けた上向きの空気吐出口(26)とを有している。ケース(23)の中には、後述するモーター駆動のファンユニット(30)を設置してある。

【0032】また、分離隔壁(14)と分配器(22)との間に、ほぼ垂直方向を向く外気吸入管(32)を設けてある。外気吸入管(32)は、分配器(22)の全高を超えて、ブロワ(18)より高い位置まで延びている。外気吸入管(32)の上端は外気吸入孔(34)に、同じく下端はブロワ(18)の吸入口(24)に接続されている。

【0033】外気吸入孔(34)は、「水分離器」としても作用する。これは、周知のように、風防窓(36)とフード(38)との接続部の近くに設けられている。この構成により、外部からの新鮮な空気は、外気吸入管(32)を通ってブロワ(18)に吸入され、蒸発器(22)を通過して処理された後に、分配器(22)に送られる。

【0034】分配器(22)には、ブロワ(18)の空気吐出口(26)に連通する下向きの空気取入れ口(40)がある。空気取入れ口(40)は、外気導通分岐管(42)と、放熱器と称される熱交換器(46)を取付けた加熱空気分岐管(44)とに連通している。

【0035】制御弁(48)は、2つの分岐管(42)と(44)とに流れる空気を分配して、各部の吹出し口を通して車室(12)内に送られる空気の温度を調節する。

【0036】この実施例では、分配器(22)は、風防窓(36)の下端部に、少なくとも1個の空気吹出し口(50)を有し、風防窓(36)の氷結や曇りを防ぐようにしてある。空気吹出し口(50)の風量は、枢動するフラップ弁(52)によって制御される。

【0037】また、分配器(22)は、車室(12)の低所に向けて開口する少なくとも1個の吹出し口(54)を備え、図示しない適宜の管路を経て、搭乗者の足付近に送風するようにしてある。空気吹出し口(54)の風量は、別のフラ

ップ弁(56)によって制御される。

【００３８】さらに分配器(22)は、側面に位置する少なくとも１個の別の空気吹出し口(58)と、中央に位置する１個の空気吹出し口(60)とを備えている。空気吹出し口(58)及び(60)の風量は、別の１個の枢動するフラップ弁(62)によって制御される。

【００３９】装置(10)の全体は、自動車の計器板(66)に、ほぼ垂直な姿勢で取付けられたハウジング(64)の中に装着されている。

【００４０】モーター駆動のファンユニット(30)により送られた空気は、蒸発器(28)を通って、必要に応じて冷却及び除湿された後、あるいは同じく必要に応じて熱交換器(46)で加熱された後、各制御弁(52)(56)(62)の設定に基づいて、各吹出し口(50)(54)(58)(60)から車室(12)内に送り出される。

【００４１】さらに装置(10)は、蒸発器(28)で凝集した水分を排出する排出管(68)を備えている。この排出管(68)は、蒸発器(28)に連通し、ブロワ(18)のケース(23)に沿って下方に延びている。排出管(68)の下端には、凝集水分を自動車の下に排出するための開口(70)を設けてある。

【００４２】外気吸入管(32)は、横方向に細長い断面形状を有している。この実施例では、この断面形を、自動車の上下方向を短辺とし、幅方向を長辺とする長方形をしてある。

【００４３】外気吸入管(32)は、分離隔壁(14)側の前面壁(72)と、それに平行な後面壁(74)とで仕切られている。前後の壁(72)及び(74)の横幅は、分配器(22)の全幅よりも広く、たとえば約３００ｍｍである。

【００４４】さらに外気吸入管(32)は、対向して設置した２個の側壁(76)(図２参照)で仕切ってある。これらの幅は狭くて、たとえば３０ｍｍ程度である。

【００４５】各側壁(76)は、車室(12)の内部に連通する循環空気吸入口(78)を備え、この吸入口(78)には、それぞれ制御用フラップ弁(80)を付設してある。各フラップ弁(80)は、図２に実線で示す循環空気吸入口(78)を閉止する位置と、破線で示す開放位置とに回動可能に、枢支されている。

【００４６】各循環空気吸入口(78)を閉止する位置とすると、モーター駆動のファンユニット(30)は、図２に矢印Ｆ１で示すように、車体外からの空気のみを吸引する。一方、循環空気吸入口(78)を開放し、２個のフラップ弁が共通のストッパ(82)に当接する位置とすると、モーター駆動のファンユニット(30)は、図２に矢印Ｆ２で示すように、車室からの循環空気のみを吸引する。フラップ弁(80)を中間位置に設定することができることは、云うまでもない。

【００４７】なお、図２に示すように、ブロワ(18)のモーター駆動されるファンユニット(30)は、２個のファン(84)を１本の水平軸(86)の両端に装着して、１個のモーター(88)によって駆動されるようになっている。２個のファン(84)には、２か所の空気吸入口(90)(92)から、空気が供給される。循環空気制御用フラップ弁(80)がどの位置にあっても、空気吸入口(90)(92)を塞ぐことがないようになっていることに、留意されたい。

【００４８】この装置(10)は、分離隔壁(14)に対してほぼ垂直な姿勢で取付けられているため、車室内に占める容積が小さく、かつ、エンジン室には全くはみださない。

【００４９】蒸発器は、自動車に空調装置を装備するか否かによって、設けたり、あるいは省略したりされる。

【００５０】

【発明の効果】(ａ)　従来の水平型の装置と異なって、垂直型に構成してあるため、計器板の下方に設置することができ、車室内の占有容積を小さくしうる。

【００５１】(ｂ)　エンジン室側には、まったくはみださないので、自動車の車体を改造する必要がない。

【００５２】(ｃ)　自動車の中心線上に設置可能な、左右対称形に構成されているので、自動車が右ハンドル式でも左ハンドル式でも、変更なしに設置することができる。

【００５３】(ｄ)　外気吸入管を横幅方向に扁平な断面形に形成してあるので、分離隔壁と装置の空気分配器との間に設置したときに、占有容積が増加せず、かつ、必要な量の外気を取り入れることができる。

【００５４】(ｅ)　装置の奥行寸法が小さく、運転席の直前の計器板の下方に設置してあるので、保守や修理作業が容易である。

【００５５】(ｆ)　請求項８に記載した構成では、空調装置の蒸発器からの凝集水分を、車体の下方に排出する管路を設けてあるので、凝集水分が車室の床などを汚すことがない。

【図面の簡単な説明】

【図１】自動車に取付けた本発明の装置の概略縦断面図である。

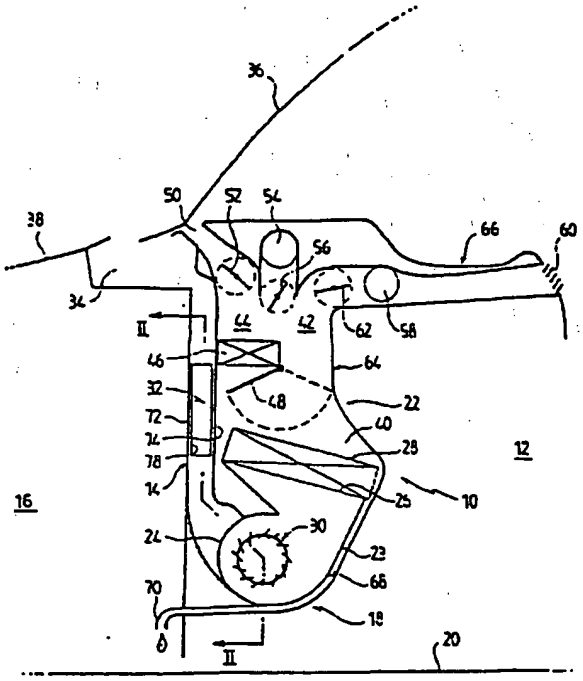
【図２】図１のII－II線における断面図である。

【符号の説明】

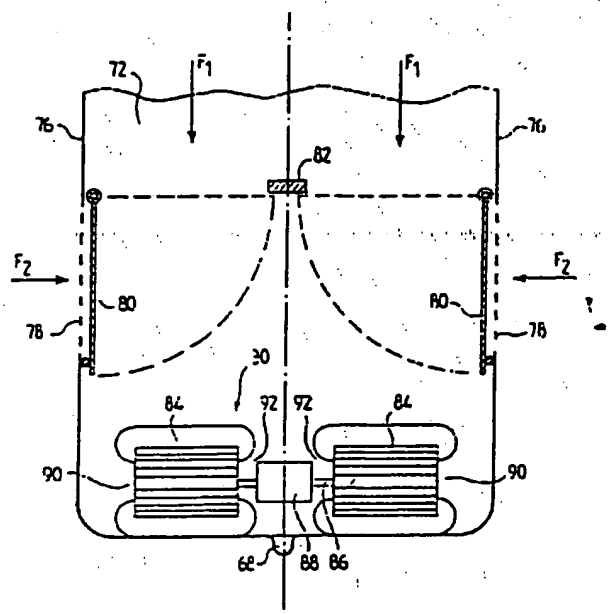
(10)暖房・換気・空調装置　(12)車室
(14)分離隔壁　(16)エンジン室
(18)ブロワ　(20)床
(22)分配器　(23)ケース
(24)吸入口　(26)吐出口
(28)蒸発器　(30)ファンユニット
(32)外気吸入管　(34)外気吸入孔
(36)風防窓　(38)フード
(40)空気取入れ口　(42)外気導通分岐管
(44)加熱空気分岐管　(46)熱交換器
(48)フラップ弁　(50)(54)(58)(60)空気吹出し口
(52)(56)(62)フラップ弁　(64)ハウジング

(66)計器板 (68)排出管 (82)ストッパ (84)ファン
(70)開口 (72)前面壁 (86)回転軸 (88)モーター
(74)後面壁 (76)側壁 (90)(92)空気吸入口 (F1)外気
(78)循環空気吸入口 (80)フラップ弁 (F2)循環空気

【図１】



【図２】



JP-A-6-156049 (page 1, abstract, construction)

A blower 18 and an air distribution unit 22 are vertically disposed so that the blower 18 occupies a lower position, and are attached to a front surface of a passenger compartment 12 under an instrument panel 66. An outside-air suction pipe 32, which is flat in a vehicle width direction, is provided between the air distribution unit 22 and a partition wall 14 for partitioning the passenger compartment 12 and an engine compartment 16. Outside air is sucked by the blower 18, and is sent into the passenger compartment by the air distribution unit 22 from discharge ports 50, 54, 58, 60 through an air-conditioning evaporator 28, a heating heat exchanger 44 and the like. An entire air conditioning apparatus occupies a small area in the passenger compartment due to a vertical type, and does not also protrude into the engine compartment. The air conditioner can be mounted on a vehicle having a right steering wheel or a left steering wheel without modification due to a lateral symmetry.

USP 4,842,046

United States Patent [19]

Stech

[11] Patent Number: 4,842,046

[45] Date of Patent: Jun. 27, 1989

[54] SLIM-LINE VAN HEATER/AIR CONDITONER UNIT

[75] Inventor: James D. Stech, Elkhart, Ind.

[73] Assignee: Quality Components, Inc., Elkhart, Ind.

[21] Appl. No.: 146,842

[22] Filed: Jan. 22, 1988

[51] Int. Cl.[4] B60H 1/00

[52] U.S. Cl. 165/42; 165/41; 237/30; 237/70

[58] Field of Search ..... 165/41, 42, 43; 237/123 B, 123 A, 30, 43

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Primary Examiner—Samuel Scott
Assistant Examiner—Allen J. Flanigan
Attorney, Agent, or Firm—Thomas J. Dodd

[57] ABSTRACT

A vehicle heater/air conditioner which includes heating and cooling coils enclosed within a housing and in flow communication with a blower member which pushes air through the housing. The housing containing the heating and cooling coils is positioned generally between the inner and outer vehicle side walls for conservation of space.

8 Claims, 1 Drawing Sheet

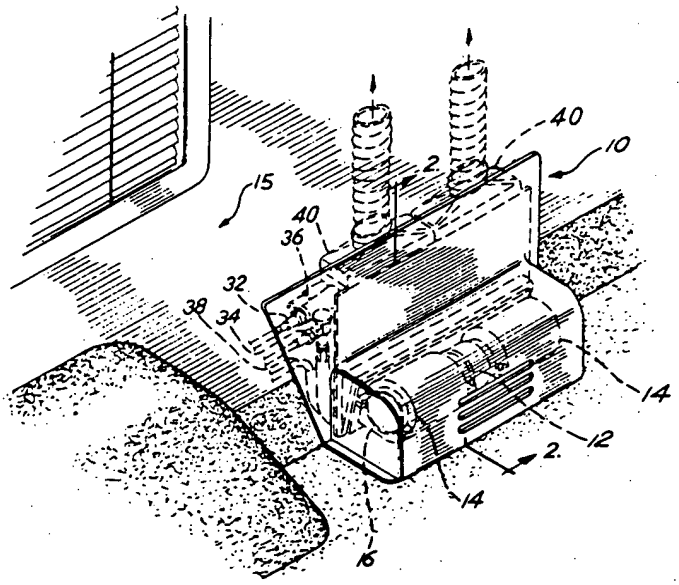
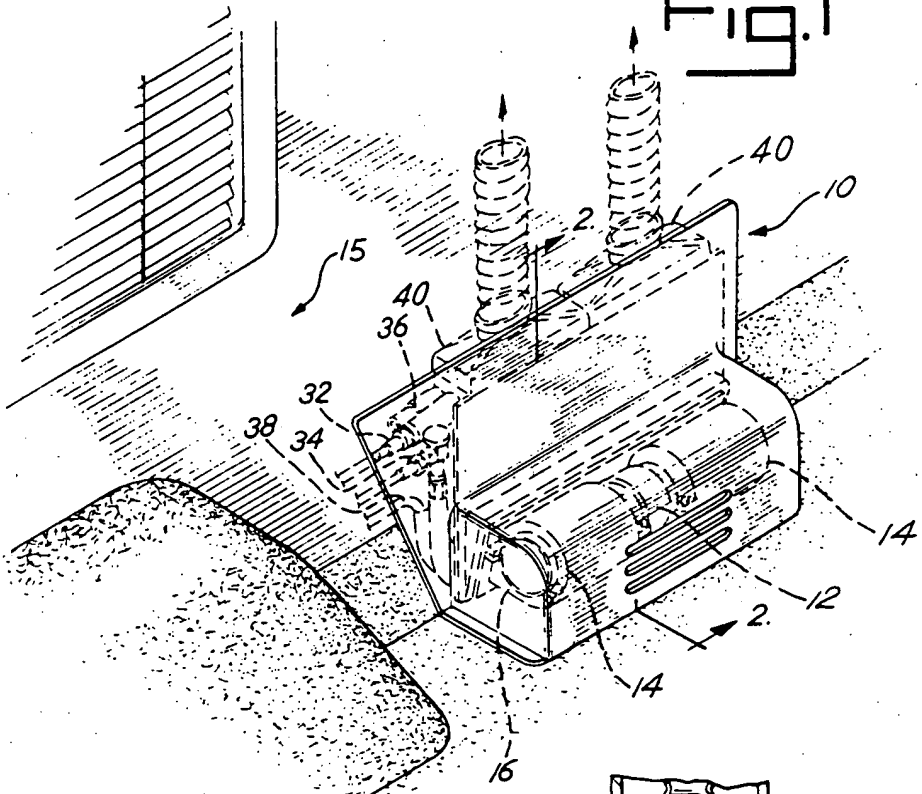


Fig. 1


40
10
2
15
40
36
32
38
34
14
12
2
14
16

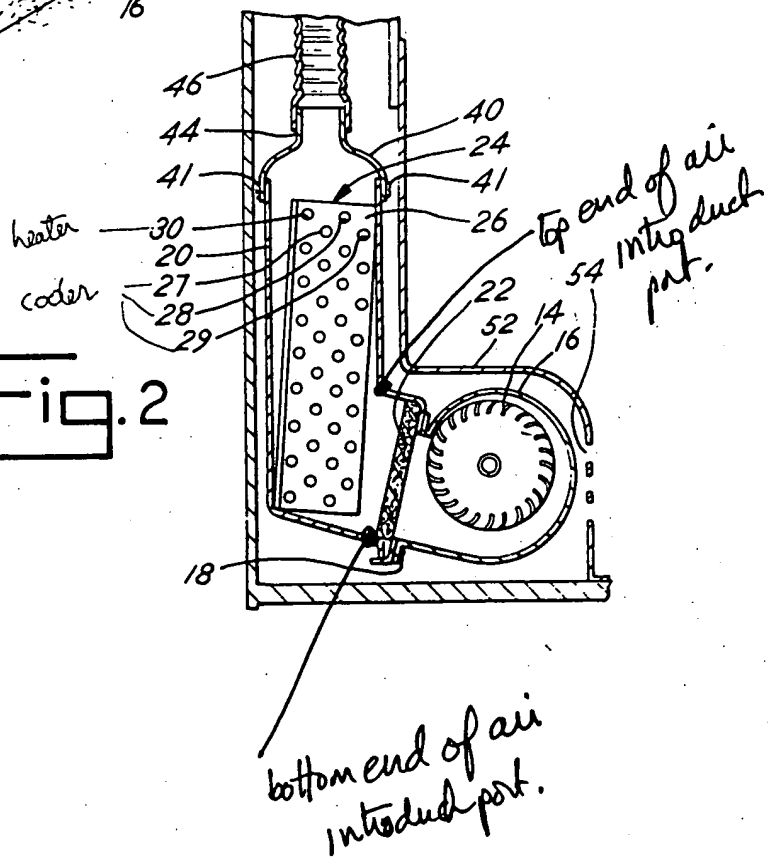

46
44
41
heater
30
20
cooler
27
28
29
40
24
41
26
Top end of air intake duct
54
22
52
14
16
18
bottom end of air intake port.

Fig. 2

SLIM-LINE VAN HEATER/AIR CONDITONER UNIT

SUMMARY OF THE INVENTION

This invention relates to a vehicles heating and air conditioning units and will have specific application to a combined heater/air conditioner which is substantially housed within the vehicle side wall.

Heretofore, air conditioning units used in mobile homes or vans or the like usually inclue a large bulky unit which is either housed on top of the vehicle or underneath one of the rearward seats. The obvious problem associated with such bulky air conditioning units is the space required by the unit which either reduces the amount of usable cabin space or if housed on top of the vehicle, creates excessive drag. Further a separate unit is generally required to heat the vehicle, thus, raising the cost of the vehicle. This invention eliminates these problems by providing for a combined heating/air conditioning unit which is generally enclosed between the vehicle's inner and outer side walls. The heating and air conditioning hoses are guided through the vehicle side wall along with the flexible tubes which lead to various air ducts within the vehicle. The only interior space consumed by the unit is that required to house the blower fans and motor which extend a few inches outwardly from the van side wall.

Accordingly, it is an object of this invention is to provide for a combined heater/air conditioner for use with a vehicle.

Another object of this invention is to provide for a heater/air conditioner unit which can be housed within the side wall of a vehicle.

Another object of this invention is to provide for a heater/air conditioner which requires a small amount of the vehicle's interior space.

Other objects of this invention will become apparent upon a reading of the following description taken along with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the heater/air conditioner of this invention shown in use in a vehicle.

FIG. 2 is a fragmentary sectional view taken along line 2—2 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment herein described is not intended to be exhaustive or to limit the invention to explain to the precise form disclosed. It is chosen and described to explain the principle of the invention and its application and practical use to enable others skilled in the art to utilize the invention.

As shown in the drawings, the combination heater-/air conditioner unit **10** includes an electric motor **12** which is connected at its oppositely extending shafts in a conventional manner to blower fans **14**. Motor **12** is connected to an electric power source (not shown) within vehicles **15**.

Blower fans **14** and motor **12** are enclosed by blower housing **16** which is connected by fasteners such screw **18** to heat exchanger housing **20**. Housing **20** accommodates an air filter **22** which is positioned directly in front of blower fans **14**.

A heat exchanger unit **24** is positioned within housing **20** and includes a multitude of heat exchanger fins **26**

(one shown), air conditioning coils **27**, **28** and **29** and a heating coil **30**. Air conditioner coils **27**, **28** and **29** are mutually connected and adapted for connection to an air conditioner compressor (not shown) by an inlet connector **32** and an outlet connector **34**. In a similar fashion, heating coil **30** is adapted for connection into the water coolant system (not shown) of vehicle **15** by inlet connector **36** and outlet connector **38**. The heat exchanger unit **24** is constructed as is common in the industry so that air conditioning coils **27**, **28** and **29** are each reverse bent across the entire length of the heat exchanger unit as is heater coil **30**. So as to maximize the heat transfer capabilities of the unit the heater and air conditioning coils are passed through in contact with fins **26** which increase the surface area exposed to the blown air.

A pair of manifolds **40** are connected to the upper end of coil housing **20** by fasteners such as screws **41**, and include a projecting mouth **44**. A flexible hose **46** is connected at one end to each projecting mouth **44** of manifolds **40**. The other ends of flexible hose **46** is connected to various air outlet ducts (not shown) throughout the vehicle (not shown).

As depicted in FIG. **2**, coil housing **20** with heat exchanger unit **24** enclosed therein is positioned between the vehicle outer wall **48** and the vehicle inner wall **50** with flexible tubes **46** extending upwardly between the walls. Motor **12** and blower fans **14** are located adjacent the vehicle floor and extend a slight distance into the vehicle's interior. Inner wall **50** extends about motor **12** and fans **13** at its wall portion **52** which includes air inlet slots **54**.

In operation, upon motor **12** being activated, blower fans **14** rotate so as to blow air through filter **22** and across heat exchanger unit **24**. The air blow through filter **22** and heat exchanger unit **24** will either be heated by coil **30** or cooled by coils **27**, **28** and **29** as selected by the the vehicle user and will exit the heating/air conditioning unit **10** through flexible tubes **46** in the direction shown by arrows **56**, into the vehicle air ducts (not shown) to heat or cool the vehicle.

It is understood that the invention is not limited to the above given details but may be modified within the scope of the appended claims.

I claim:

1. A heat exchanger unit in combination with a vehicle having an outer and an inner side wall, said unit including a heat exchanger means for cooling or warming air, blower means for delivering said air to said heat exchanger means, duct means in air flow communication with said heat exchanger means for delivering said air to an interior of said vehicle, said heat exchanger means enclosed by a housing, the improvement wherein said housing and said heat exchanger means are positioned substantially between an outer side wall and an inner side wall of said vehicle, said blower means in air flow communication with said heat exchanger means and including a housing enclosing the blower means connected to said heat exchanger means housing.

2. The heat exchanger of claim **1** wherein said blower means is in air flow communication between said heat exchanger means and the interior of said vehicle through said inner side wall.

3. The heat exchanger of claim **2** wherein said blower means is located adjacent a floor of said vehicle.

4. The heat exchanger of claim 2 and including a filter element positioned between said blower means and said heat exchanger means.

5. The heat exchanger of claim 1 wherein said heat exchanger unit includes a core having tubing for accommodating a cooling fluid and separate tubing for accommodating a heating fluid.

6. A heat exchanger unit in combination with a vehicle having an outer and an inner side wall, said unit including a heat exchanger means for cooling or warming air, blower means for delivering said air to said heat exchanger means, duct means in air flow communication with said heat exchanger means for delivering said air to an interior of said vehicle, said heat exchanger means enclosed by a housing, said housing and said heat exchanger means positioned substantially between an outer side wall and an inner side wall of said vehicle, said blower means in air flow communication between said heat exchanger means and the interior of said vehicle through said inner side wall.

7. A heat exchanger of claim 6 and including a filter element positioned between said blower means and said heat exchanger means.

8. A heat exchanger of claim 6 wherein said blower means is located adjacent a floor of said vehicle.

* * * * *

JP 2-17388

⑲日本国特許庁(JP)　⑪特許出願公開

⑫公開特許公報(A)　平2-17388

⑤1Int.Cl.⁵　識別記号　庁内整理番号　⑬公開　平成2年(1990)1月22日
F 28 D 13/00　7711-3L

審査請求　未請求　請求項の数 6　(全6頁)

⑤4発明の名称　流動層熱交換器

⑳特　願　昭63-167499
㉒出　願　昭63(1988)7月5日

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明　細　書

1．発明の名称

流動層熱交換器

2．特許請求の範囲

(1)流動層熱交換器の外形を形成すると共に、その一側面側に空気を導入するための開口穴と、その他側面側に導入された空気を導出するための開口穴を有するケースと、

このケース内に配され、被熱交換流体が内部を流れる複数本のチューブと、

前記ケース内であって、前記チューブの外周囲に配される複数個の粒子と、

前記ケース内であって、前記ケースの一側面側から他側面側に向けて延び、前記ケース内において、

前記空気の通過方向と垂直方向に並ぶと共に、上下方向に積層される流動室に区画する仕切板とを備えることを特徴とする流動層熱交換器。

(2)前記ケースの中心側に位置する流動室内には、前記ケース内壁側に位置する流動室内に比べ多くの粒子が封入されていることを特徴とする請求項1記載の流動層熱交換器。

(3)前記空気流れに対して前記一側面側より上流側に設けられ、前記空気の案内路を形勢すると共に、前記各流動室に送られる空気量を均一にする案内部材を備えることを特徴とする請求項1記載の流動層熱交換器。

(4)前記ケースの一部は前記流動層熱交換器に向け空気を導入するダクトの一部より構成されることを特徴とする請求項1、2又は3記載の流動層熱交換器。

(5)前記ケースの一側面側及び他側面側は複数の開口穴を有する網目状部材よりなることを特徴とする請求項1、2、3又は4記載の流動層熱交換器。

(6)前記流動室は重力方向に対して、所定の角度をもって積層されることを特徴とする請求項1、2、3、4又は5記載の流動層熱交換器。

3．発明の詳細な説明

〔産業上の利用分野〕

本発明は流動層熱交換器に関し、特に自動車用空調装置のエバポレータに用いて有効である。

〔従来の技術〕

従来より、流動層を用いた熱交換器は粒子が風圧による浮遊と重力による落下により流動する特性を利用するものである。つまり、上下方向の空気の流れの中で使用するのが一番効率が良い。

従って、ほとんどの流動層熱交換器は下方から空気を供給し、上方に向けて排出している（特開昭59－48888号公報、特開昭60－114696号公報、特開昭62－33290号公報等）。

車両等においては取付けスペース、位置等の制約上、空気の流れが上下方向に通さないものが多く、第8図に示す様に横方向（矢印A）からの空気を、一旦流動層熱交換器100を通過する際、上下方向の流れに変え、再び横方向（矢印B）の流れに変える必要がある。

〔発明が解決しようとする課題〕

しかしながら、上記の様な構成ではダクト13内を通過する空気の流れが一方向だけでないことや、空気がダクトに衝突した後、流動層熱交換器100を通過するため、空気の通風抵抗が大きく粒子が浮遊しにくいという問題があった。

また、第9図に示す様に、流動層熱交換器100を傾斜させて取付けた場合、粒子102が流動層熱交換器100の下方に沈滞し、空気が通過しても流動層熱交換器100の上方では粒子100がほとんど浮遊しない層が存在する。

つまり、従来の流動層熱交換器では車両等に熱交換器を傾斜させて取付けて用いる場合、粒子が均一に浮遊運動せず、十分に熱交換がされないという問題があった。

そこで本発明は横方向からの空気の流れに対しても粒子を均一に浮遊運動させることにより熱交換効率を緩和させ、また車両等への搭載性のすぐれた流動層熱交換器を提供することを目的とする。

〔課題を解決するための手段〕

本発明は流動層熱交換器を形成するケースの一側面側と他側面側との間を仕切板によって区画し、前記ケース内において、空気の通過方向を垂直方向に並び、上下方向に積層された流動室を形成する。

前記ケースの中心側に位置する流動室には、前記ケース内壁側に位置する流動室に比べ、多くの粒子が封入されている。

また、空気の流れに対してケースの一側面側より上流側に空気の案内路を形成し、各流動室に送られる空気量を均一にする案内部材を備える。

前記ケースの一部は前記流動層熱交換器に向け空気を導入するダクトの一部より構成される。

さらに前記ケースの一側面及び他側面は複数の開口穴を有する網目状部材よりなる。

前記流動室は重力方向に対して、所定の角度をもって積層されている。

〔作用〕

仕切板によって区画された各流動室に粒子が封入されているため、一部に粒子が沈滞することがなく、各流動室内で粒子が均一に浮遊運動する。

また、風速の速い流動室には多くの粒子が封入され、風速の比較的遅い流動室にはやや少なめに粒子が封入されているため、さらに各流動室内で粒子が均一に浮遊運動する。

また、空気の流れに対してケースの一側面側より上流側に空気の案内路を形成し、各流動室に送られる空気量を均一にする案内部材を備えているため、各流動室を通過する空気の風速分布が均一になり、各流動室内で粒子が均一に浮遊運動する。

〔発明の効果〕

以上のことにより、各流動室内で粒子が均一に浮遊運動するため、流動層熱交換器本体を傾斜させて取付けることができ、熱交換効率も向上する。

さらに、取付スペース・位置等の制約のある車両等においても、十分対応することができ、車両

搭載性にも優れている。

〔実施例〕

以下、本発明流動層熱交換器の一実施例を図面に基づき説明する。

第４図に示す様に、空気を導入する送風機１０が送風機ケース１１内に設けられている。送風機ケース１１には外気導入口１１ａ及び内気導入口１１ｂが設けられ、さらに外気の導入もしくは内気の循環を切替える内外気切替ダンパ１２が回動可能に設けられている。

送風機ケース１１の開口部には通風ダクト１３の一端が接続されている。そして、この通風ダクト１３内には後述する流動層熱交換器（以下エバポレータと称す）１００が設けられている。さらに通風ダクト１３内にはヒータコア（省図示）、エアミックスダンパ（省図示）等が設けられ、空気の温度調節を行っている。

そして、通風ダクトの他端は、車室内への空気の吹出を行う各吹出口に向けて接続されている。

第１図及び第２図に示す様に、通風ダクト１３内にエバポレータ１００が設けられている。

このエバポレータ１００は空気の主流の水平方向の流れ（矢印Ｆ）に対し、エバポレータ１００の取付け、空気の流れ等を考慮してθ＝２０～６０℃程度の傾きで設けられている。

ここで、エバポレータ１００の構成を以下に示す。

偏平形状を有し、内部を冷媒が流れるチューブ１０１が平行に複数列、複数段設けられている。そして、これらのチューブ１０１は通風ダクト１３を貫通し、通風ダクト外にて各チューブが夫々接続されている。

このチューブ１０１間にポリスチレンもしくはAl_2O_3からなり、直径が0.１～１㎜程度の粒子１０２を封入する。そして、チューブ１０１の上流側に設けられ、粒子１０２の飛散及び落下を防止するアルミ製の網目形状を有する第１飛散防止板１０３とチューブ１０１の下流側に設けられ、粒子１０２の飛散を防止するアルミ製の網目形状を有する第２飛散防止板１０４が設けられ、複数のチューブ１０１を囲む様に通風ダクト１３に接続されている。ここで、第１飛散防止板１０３が、第２飛散防止板１０４、通風ダクト１３によりケースが構成されている。

さらに、アルミからなる平板状の仕切板１０５の一端が第１飛散防止板１０３に他端が図中上段のチューブ１０１の下部１０１ｂにろう付等により接続され、アルミからなる平板状の仕切板１０６の一端が第２飛散防止板１０４に、他端が図中上段のチューブ１０１の上部１０１ａにろう付等により接続されている。

これらの仕切板１０５及び１０６により第１飛散防止板１０３と第２飛散防止板１０４との間が区画され、複数の流動室１０７が形成されている。この流動室１０７は夫々が独立した部屋となっており、各流動室１０７にはほぼ同一量の粒子１０２が封入されており、粒子１０２は各独立した流動室１０７内でのみ浮遊運動する。よって、エバポレータ１００の下方部に粒子１０２が集まり沈溶することはなくなる。

尚、粒子１０２の層の高さは粒子が活発に流動し、熱交換効率が良好になるようにエバポレータ１００を傾斜させた状態で落下防止板１０４から３㎜以上とする。また、各仕切板の間隔は粒子が均一に流動するように粒子１０２の直径の１０倍以上離して設ける。

また、第３図に示す様に第１飛散防止板１０３及び第２飛散防止板１０４は通風ダクト１３の内周に設けられた断面長方形状の固定溝１３ａに挿入されている。そして、突部１３ｂより図示しないボルト等を係め込むことにより、第１飛散防止板１０３及び第２飛散防止板１０４を通風ダクト１３に接続固定する。

次に、作動について説明する。

送風機１０が作動すると、内外気切替ダンパ１２の位置により空気を循環もしくは外気を導入し、内気もしくは外気がエバポレータ１００を通過する。

このとき、チューブ１０１内を冷媒が流れ、粒

子１０２が各流動室１０７内で流動する。そして、空気とチューブ１０１外壁とが熱交換を行う。さらに、粒子１０２が流動することにより、粒子１０２がチューブ１０１外壁に衝突し、粒子１０２とチューブ１０１外壁とが熱交換したり、粒子１０２が空気とチューブ１０１外壁との温度境界層を破壊することにより、熱交換が促進される。そして、このエバポレータ１００を通過して冷却された空気は適度な温度に調節され、車室内に導かれる。

第５図に粒子１０２を有さない単相流エバポレータの場合と、粒子１０２を有したエバポレータで仕切板無と仕切板有の場合の風速と熱交換量を比較したデータを示す。

仕切板１０５及び１０６有の場合、風速が１m/sを越えると熱交換量は減少するが、通常の最適な風速１m/s 付近では単相流に比べてはもちろんのこと、仕切板１０５及び１０６無の場合に比べ、２～３倍程度の熱交換量を得ることができる。

また、仕切板１０５及び１０６を設けることにより、第１飛散防止板１０３及び第２飛散防止板１０４のたわみを防止することができる。

次に、他の実施例について説明する。

さらに粒子１０２を均一に流動化するため、第６図に示す様に風速分布（図中矢印Wは空気の相対的な速度を示す）を考慮し、風速の比較的速い位置にある中心側の流動室１０７ａの粒子量を風速の比較的遅い通風ダクト１３内壁側の位置にある流動室１０７ｂの粒子量に比べ、多くする。

よって、風速の違いにより各流動室１０７内に封入する粒子量を変えているため、各流動室１０７内の粒子１０２はさらに均一に流動する。

つまり、エバポレータ１００の熱交換効率は向上し、エバポレータ１００内を通過する空気は均一に冷却される。

その他の構成・作動は一実施例と同様である。

また、粒子１０２の均一な流動化を得るために、第７図に示す様に、第１飛散防止板１０３の上流側にアルミからなる平板状の案内部材である案内板１４を仕切板１０５の直下に第１飛散防止板１０３を間に介してろう付等により接続する。

この案内板１４は、風速の比較的速い中央付近では各案内板１４の間隔の狭い空気の案内路Ｂを形成し、風速の比較的遅い通風ダクト１３の近傍では通風ダクト１３と案内板１４の間隔の広い案内路Ａを形成する。

よって、各流動室１０７に同程度の風量を供給することができるため、各流動室１０７内で粒子１０２が均一に流動する。つまり、エバポレータ１００の熱交換率は向上し、エバポレータ１００内を通過する空気は均一に冷却される。

その他の構成・作動は一実施例と同様である。

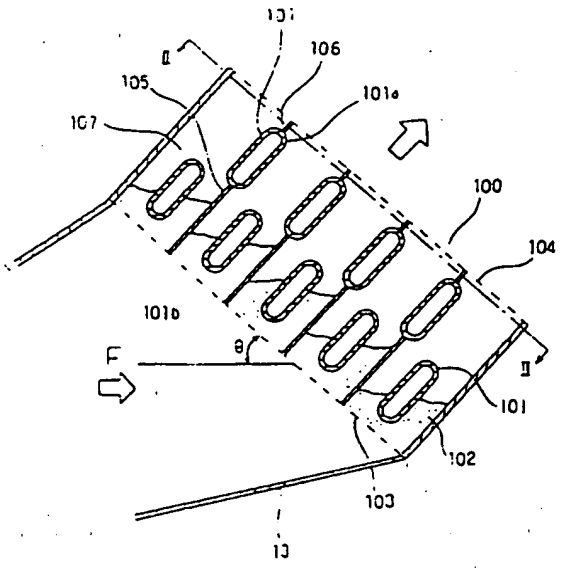
尚、本発明では流動層熱交換器をエバポレータに用いたが、ラジエータ、ヒータコア等にも用いることができる。

４．図面の簡単な説明

第１図は本発明の一実施例を示す流動層熱交換器の断面図、第２図は第１図のⅡ－Ⅱ断面図、第３図はダクトと第１の部材及び第２の部材との接続部を示す要部拡大図、第４図は従来の一例を示す流動層熱交換器の流動状態図、第５図は本発明の一実施と従来の一例の風速の熱交換量の関係を示す風速－熱交換量線図、第６図は本発明の他の実施例を示す流動層熱交換器の断面図、第７図は本発明の更に他の実施例を示す流動層熱交換器の断面図、第８図は従来の一例を用いた自動車用空調装置を示す模式図、第９図は従来の一例を示す流動層熱交換器の流動状態図である。

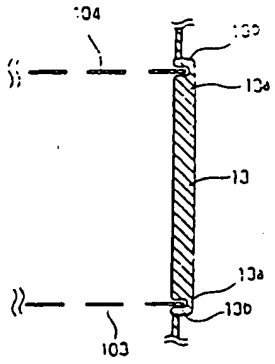
１３…ダクト，１４…案内部材，１００…流動層熱交換器，１０１…チューブ，１０２…粒子，１０４…一側面側，１０４…他側面側，１０５，１０６…仕切板，１０７…流動室。

代理人弁理士　岡　部　　隆

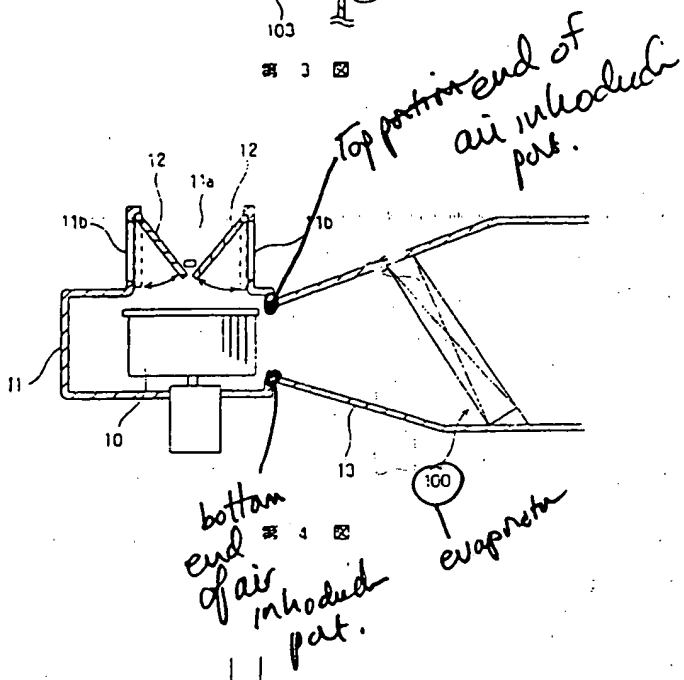


13 … ダクト(ケース)
100 … 流動層熱交換器
101 … チューブ
102 … 入口
103 … 一側面側(ケース)
104 … 他側面側(ケース)
105, 106 … 仕切り
107 … 流動室

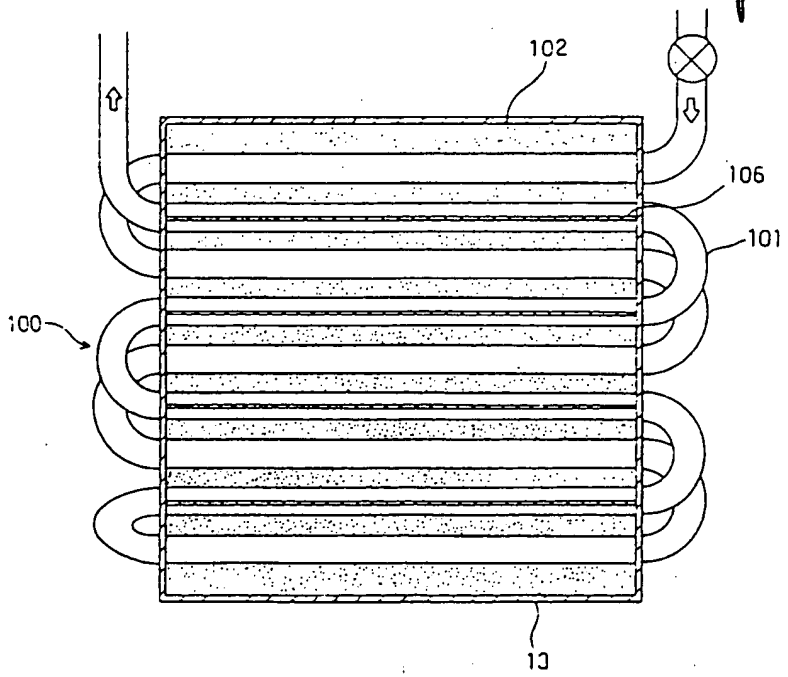
第 1 図



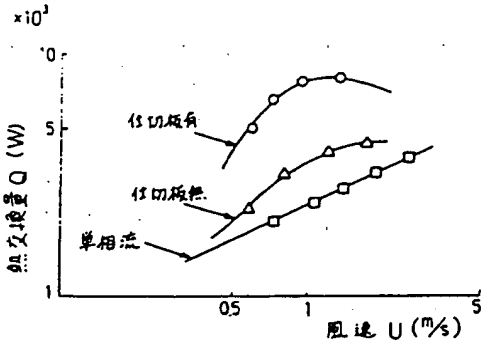
第 3 図



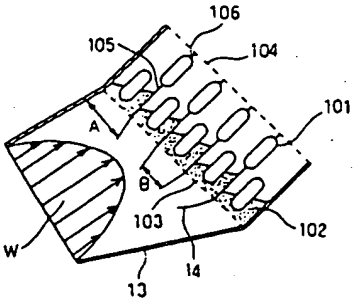
第 4 図



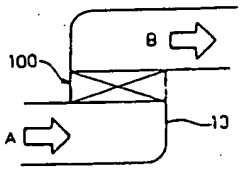
第 2 図



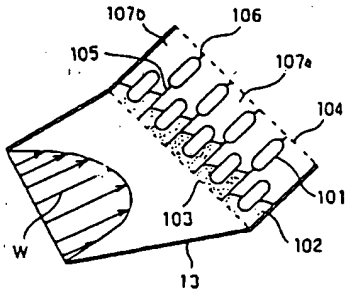
第 5 図



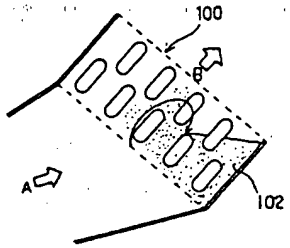
第 7 図



第 8 図



第 6 図



第 9 図

CLIPPEDIMAGE= JP402017388A
PAT-NO: JP402017388A
DOCUMENT-IDENTIFIER: JP 02017388 A
TITLE: FLUIDIZED BED HEAT EXCHANGER
PUBN-DATE: January 22, 1990
INVENTOR-INFORMATION:
NAME
NOSAKA, KAZUTO
OHARA, TOSHIO
YAMAMOTO, TOSHIHIRO
ASSIGNEE-INFORMATION:
NAME COUNTRY
NIPPON DENSO CO LTD N/A
APPL-NO: JP63167499
APPL-DATE: July 5, 1988
INT-CL (IPC): F28D013/00
US-CL-CURRENT: 165/166,165/170

ABSTRACT:
PURPOSE: To make uniform levitating motion of particles in a fluidized chamber, improve thermal efficiency and permit the slanted mounting of a main body by providing partitioning plates, arranged orthogonally to the passing direction of air and defining the title heat exchanger into the fluidized chambers laminated in up-and-down direction.

CONSTITUTION: An evaporator 100 is provided in a ventilating duct 13. A space between dispersion preventing plates 103, 104 is divided by partitioning plates 105, 106 to form a plurality of fluidized chambers 107. Particles 102 effect levitating motions in only respective independent fluidized chambers 107. Accordingly, the particles will never be collected and stagnated below the evaporator 100. Refrigerant flows into a tube 101 and heat exchange between air and the outer wall of the tube 101 is effected. A guide plate 104 provides a narrow guiding passage near the center of a heat exchanger, whereat an air speed is high, and provides a wide guiding passage at a part whereat the air speed is low. The particles perform uniform levitating motions

in such a
manner whereby the main body of the heat exchanger may be mounted slantedly and
heat exchanging efficiency may be improved.

JP 63-17107

⑲日本国特許庁(JP)　⑪特許出願公開

⑫公開特許公報(A)　昭63-17107

⑤1Int.Cl.⁴	識別記号	庁内整理番号	⑬公開　昭和63年(1988)1月25日
B 60 H 1/00	102	U-7153-3L	

審査請求　未請求　発明の数 1　(全5頁)

⑤4発明の名称　自動車用空調装置

⑳特　願　昭61-162375

㉒出　願　昭61(1986)7月10日

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明　細　書

1. 発明の名称

自動車用空調装置

2. 特許請求の範囲

(1) 運転座席後方に後部乗員座席が設けられた自動車における後部乗員座席上の乗員のための空調装置であって、上記後部乗員座席に対応する車体側壁の車室側表面には吹出口が設けられており、上記車体側壁の閉断面内にはエアコンユニットおよび該エアコンユニットと上記吹出口とを連通する空調風ダクトが配設されており、上記エアコンユニットには、車体側壁の閉断面内に配設された外気を導く外気導入ダクトが連通され、該外気導入ダクト内には外気の導入量を可変とする弁体が設けられていることを特徴とする自動車用空調装置。

3. 発明の詳細な説明

(産業上の利用分野)

本発明は、自動車用空調装置に関し、特に、運転座席後方に後部乗員座席が設けられた自動車における後部乗員座席上の乗員のための空調装置の改良に関する。

(従来の技術)

従来、ワゴン車や小型バスのように運転座席後方に後部乗員座席が複数列配設された自動車においては、乗用車の場合のように運転座席側方の前側に空調装置を設けただけでは後部乗員座席側で十分な空調効果が得られないので、上記空調装置とは別に後部乗員座席上の乗員のための空調装置を設けることがある。

そして、この種の空調装置としては、例えば実公昭57-30179号公報に開示されるように、エバポレータおよびブロアを収納したエアコンユニットを車室内の運転座席後方から最後部までの間の車体側壁面に配置し、該エアコンユニットから延出するダクトを車体側壁面の窓の下方に沿って設置し、該ダクトに各後部乗員座席に対応して吹出口を設けたものが一般によく知られている。

(発明が解決しようとする問題点)

ところが、上記従来の空調装置では、エアコン

ユニットおよびダクトが車体側壁面より車室側に突出した状態で設けられているため、これらにより車室内の有効空間が狭められるという問題があった。

また、この種の空調装置は、従来、運転座席側方の前側に設けられる空調装置の場合のように外気を車室内に導入する構成にはなっていないが、この構成を採用することが要請されている。すなわち、小型バス等では、車室内がかなり広いため、運転座席側の空調装置で外気を車室内に導入しただけでは車室内全体、とりわけ後部乗員座席側での換気を十分に行うことができないからである。

本考案はかかる諸点に鑑みてなされたものであり、その目的とするところは、上記エアコンユニットおよびダクトの配設を適切に設定して、車室内の有効空間を広く確保でき、かつ外気の車室内の後部乗員座席側への導入を実施上有効に可能とする空調装置を提供せんとするものである。

（問題点を解決するための手段）

上記目的を達成するため、本発明の解決手段は、運転座席後方に後部乗員座席が設けられた自動車における後部乗員座席上の乗員のための空調装置として、次のような構成にするものである。

すなわち、上記後部乗員座席に対応する車体側壁の車室側表面に吹出口を設ける一方、上記車体側壁の閉断面内に、エアコンユニットおよび該エアコンユニットと上記吹出口とを連通する空調風ダクトを配設する。また、上記エアコンユニットに、車体側壁の閉断面内に配設された外気を導く外気導入ダクトを連通し、該外気導入ダクト内に外気の導入量を可変とする弁体を設ける構成としたものである。

（作用）

上記の構成により、本発明の空調装置では、外気導入ダクト内の弁体を閉じた状態において、エアコンユニットを作動させたときには、該エアコンユニットからの空調風が空調風ダクトを通して吹出口より後部乗員座席に向けて吹出されることにより、従来と同様に後部乗員座席側で空調効果が発揮される。

一方、上記弁体を開いたときには、外気が外気導入ダクトを通してエアコンユニットに取かれ、該エアコンユニットから空調風ダクトを通して吹出口より後部乗員座席に向けて吹出されることにより、車室内の後部乗員座席側での換気を十分に行うことができることになる。

しかも、上記エアコンユニットおよびダクト（空調風ダクトと外気導入ダクト）は共に車室外たる車体側壁の閉断面内に配設されているので、これらの配設により車室内の有効空間が狭められることはない。また、上記外気導入ダクトは、エアコンユニットが車体側壁の閉断面内という車外に近接した箇所に設けられているので、その長さを短くでき、また配管も容易なものとなる。

（実施例）

以下、本発明の実施例を図面に基づいて説明する。

第１図ないし第６図は本発明の一実施例に係る空調装置を備えた小型バスを示し、この小型バスは、運転座席１の後方に後部乗員座席２，２，２が３列配設されてなる。上記各後部乗員座席２は、シートクッション３下面に脚４，…を有するベンチシートよりなり、その脚４は、車体フロア面を構成するフロアパネル５上に固定されている。６は車体側壁であって、該車体側壁６の上部にはウインドガラス７，…が設けられているとともに、車体側壁６の下部つまりウインドガラス７下側は、アウタパネル８とインナパネル９とで閉断面状に形成されており、該インナパネル９の下部には上記フロアパネル５の側縁部が接合されている。

そして、上記車体側壁６のインナパネル９には、前列の後部乗員座席２と中央列の後部乗員座席２との間のフロアパネル５近傍に内気吸入口１０が設けられているとともに、中央列の後部乗員座席２に対応するウインドガラス７の下側近傍に吹出口１１が設けられている。一方、中央列の後部乗員座席２に対応する車体側壁６の閉断面内の下部にはエアコンユニット１２が配設されており、該エアコンユニット１２は、シロッコファンよりなるブロア１３と、該ブロア１３の下流側（吹出口

部１３ａ側）と連通するエバポレータ１４とを備えている。

また、上記車体側壁６の閉断面には、上記エアコンユニット１２のエバポレータ１４下流側と吹出口１１とを連通する空調風ダクト１５が配設されているとともに、上記内気吸入口１０から車室内のエア（内気）をエアコンユニット１２のブロア１３の吸入口部１３ｂに導く内気導入ダクト１６が配設されている。上記内気導入ダクト１６には、車体側壁６のアウタパネル８に設けられた外気吸入口１７から外気を上記ブロア１３の吸入口部１３ｂに導くための外気導入ダクト１８が接続されており、この接続部では内気導入ダクト１６と外気導入ダクト１８とがＴ字路を形成している。

上記外気導入ダクト１８内には該ダクト１８を開閉して外気の導入量を可変とする弁体１９が設けられており、該弁体１９は、ワイヤ２０を介して、車体側壁６のインナパネル９の吹出口１１前側に設けられた操作レバー２１に連結され、該操作レバー２１により開閉操作されるようになっている。以上によって、後部乗員座席２上の乗員のための空調装置が構成されている。尚、２３はドレインパイプである。

次に、上記実施例の作用・効果について説明するに、通常の空調時、外気導入ダクト１８内の弁体１９を閉じた状態において、エアコンユニット１２を作動させると、ブロア１３の吸引力により車室内のエアが内気吸入口１０から内気導入ダクト１６を通してエアコンユニット１２内に吸引され、該エアコンユニット１２のエバポレータ１４で熱交換により冷却される。この冷却されたエアつまり空調風は、エアコンユニット１２から空調風ダクト１５を通して吹出口１１に送給され、該吹出口１１から後部乗員座席２に向けて冷風として吹出され、これにより、後部乗員座席２上の乗員に対する空調効果（冷房効果）を十分に発揮できる。

一方、車室内の換気を行う場合には、外気導入ダクト１８内の弁体１９を開くとともに、エアコンユニット１２において、ブロア１３のみを作動させ、エバポレータ１４を作動停止状態（熱交換を行わない状態）にする。そして、このような状態においては、走行風としての外気が上記ブロア１３の吸引力と相俟って外気吸入口１７に流入し、外気導入ダクト１８および内気導入ダクト１６を通してエアコンユニット１２に導かれた後、該エアコンユニット１２から空調風ダクト１５を通して吹出口１１より後部乗員座席２に向けて吹出され、これにより、車室内の後部乗員座席２側での換気を十分に行うことができる。

しかも、上記エアコンユニット１２およびダクト（空調風ダクト１５と内気導入ダクト１６と外気導入ダクト１８）は共に車室外たる車体側壁６の閉断面内に配設されているので、これらの配設により車室内の有効空間が狭められることはない。

また、上述の如く外気を車室内の後部乗員座席２側に導入する構造においては、エアコンユニット１２等が車体側壁６の閉断面内という一つの板部材（車体側壁６のアウタパネル８）のみを隔てて車外に隣接した部位に設けられているので、外気導入ダクト１６は長さの短いもので足り、またその配管も容易となり、実施する上で有利である。

（発明の効果）

以上の如く、本発明の自動車用空調装置によれば、エアコンユニットおよびダクトが共に車室側たる車体側壁の閉断面内に配設されているとともに、外気を車室内の後部乗員座席側に吹出し得るようになっているので、車室内の有効空間を狭めることなく空調装置を設置することができ、また換気空調性を実施上有効に高めることができるものである。

4. 図面の簡単な説明

図面は本発明の実施例を示すもので、第１図は小型バスの車室内における空調装置の設置状態を示す概略側面図、第２図は空調装置の全体構成を示す一部切開側面図、第３図および第４図はそれぞれ第２図のⅢ－Ⅲ線およびⅣ－Ⅳ線における断面図、第５図は外気吸入口の配設状態を示す斜視図、第６図は弁体およびその操作機構の構成を示す模式図である。

1…運転座席、2…後部乗員座席、11…吹出口、12…エアコンユニット、15…空調風ダクト、18…外気導入ダクト、19…弁体。

特許出願人　マツダ株式会社

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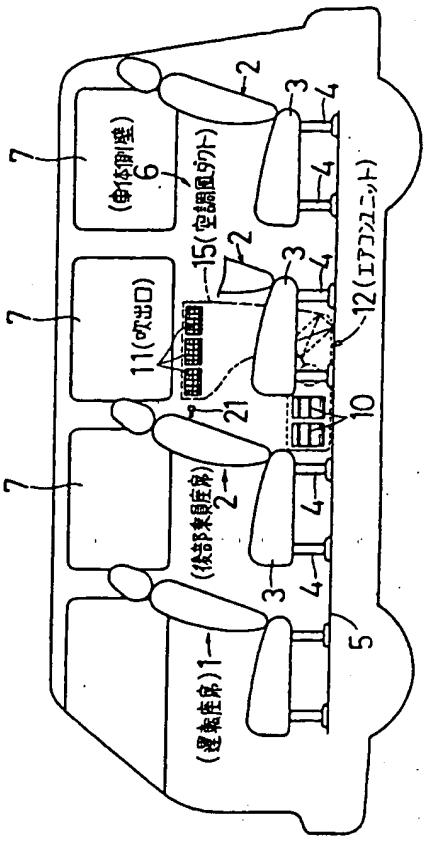
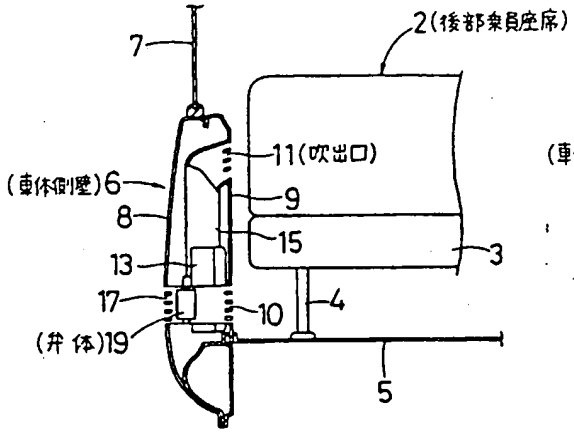
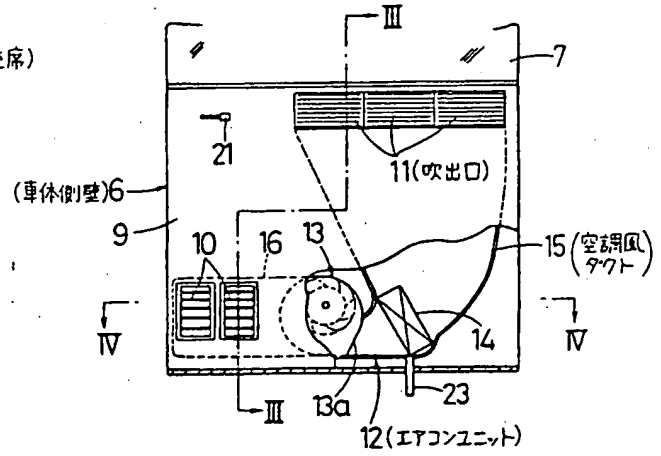
第1図



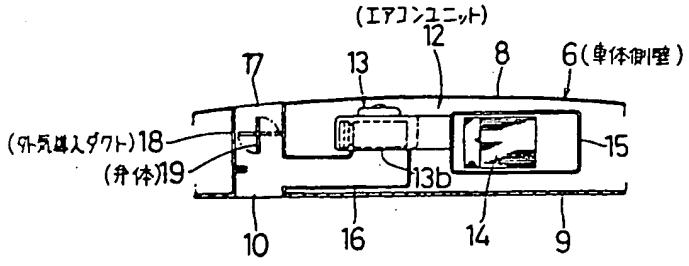
第3図



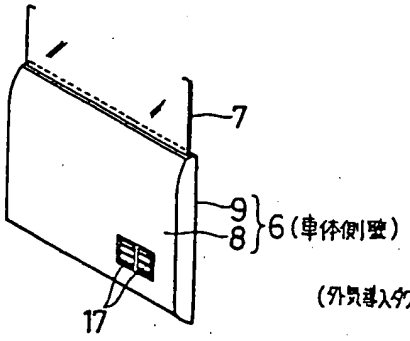
第2図



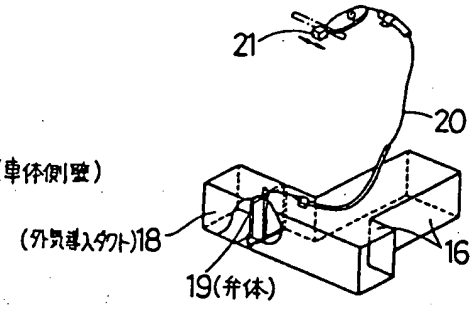
第4図



第5図



第6図



PAT-NO: JP363017107A

DOCUMENT-IDENTIFIER: JP 63017107 A

TITLE: AIR-CONDITIONING DEVICE

PUBN-DATE: January 25, 1988

INVENTOR-INFORMATION:
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ASSIGNEE-INFORMATION:
NAME COUNTRY
MAZDA MOTOR CORP N/A

APPL-NO: JP61162375

APPL-DATE: July 10, 1986

INT-CL (IPC): B60H001/00

US-CL-CURRENT: 237/28

ABSTRACT:

PURPOSE: To make it possible to install an air-conditioning device without narrowing the effective space in the passenger's compartment of a vehicle and to enhance the ventilation for the passenger's compartment, by disposing an air-conditioning unit and a duct within the closed cross-sectioned area of one side wall of the vehicle body, and by blowing the outside air into the rear seat section in the passenger's compartment.

CONSTITUTION: An inside air suction port 10 and a blow-out port 11 are formed in the inner panel 9 of one side wall 6 of a vehicle body. Further, an air-conditioning unit 12 is disposed within the closed cross-sectioned area of the one side wall 6 of the vehicle body, and is composed of a blower 13 and an evaporator 14. Further, an air-conditioning duct 15 communicating between the evaporator 14 and the blow-out port 11 and an inside-air introduction duct 16 for leading the inside air into the blower 13 through the inside air suction port 10 are disposed in the closed cross-sectioned area of the one side wall 6 of the vehicle body. An outside air introduction duct 18 for leading the outside air into the blower 13 through an outside air suction port 17 formed in the outer panel of the one side wall 6 of the vehicle body, is connected to the inside air introduction duct 16, and is provided therein with a valve element 19 for changing the amount of introduction of the outside air.

USP 2,728,206

Dec. 27, 1955 A. B. NEWTON ET AL 2,728,206

SYSTEM FOR HANDLING CONDENSATE

Filed Nov. 23, 1951

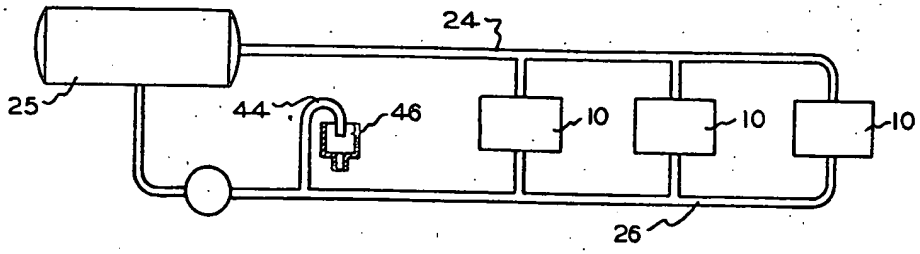

FIG. III.

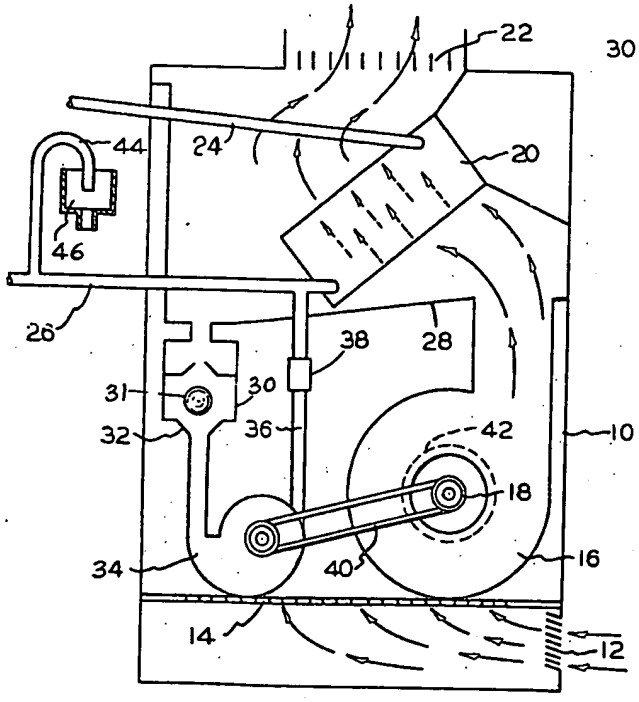

FIG. I.

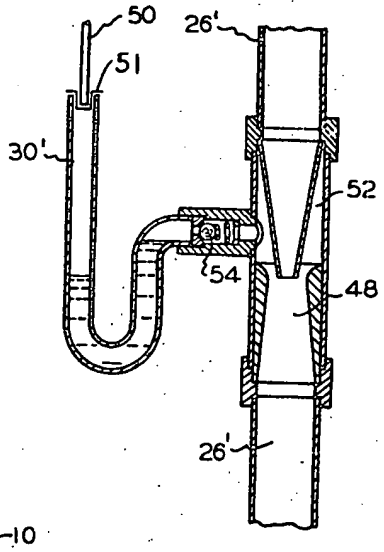

FIG. II.

INVENTORS

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AND RONALD S. DRAKE

BY Truman A. Beaman

ATTORNEY

United States Patent Office

2,728,206

Patented Dec. 27, 1955

2,728,206

SYSTEM FOR HANDLING CONDENSATE

Alwin B. Newton and Ronald S. Drake, Jackson, Mich., assignors to Acme Industries, Inc., Jackson, Mich., a corporation of Michigan

Application November 23, 1951, Serial No. 257,856

1 Claim. (Cl. 62—140)

The present invention relates to improvements in a system for the automatic return of condensate, preferably from a plurality of air conditioning units, or similar apparatus, through which chilled water is being circulated and resulting in condensation being formed.

It has been the practice in the handling of condensate from individual room air conditioning units to either pipe each unit to a sewer connection or to provide each unit with a receptacle into which the condensate is directed and accumulated and then periodically emptied.

According to the present invention, the condensate from each air conditioning unit is preferably discharged into the circulating system for the chilled water. This avoids a sewer connection for each unit, reduces piping to a minimum and permits the use of the condensate for make-up water. It is immaterial, according to the present invention, whether the condensate is being discharged into the chilled water line flowing to or returning from the air conditioning unit.

One of the objects of the invention is to provide a system of handling condensate in an air conditioning system in which the condensate is discharged into the chilled water circulating system.

Another object is to provide a system of condensate handling in air conditioning and other similar apparatus in which the condensate is periodically and automatically discharged into the circulating system of the chilled water.

These and other objects and advantages residing in the construction, combination and arrangement of parts and the resulting system will more fully appear from a consideration of the following specification with the appended claim.

In the drawings,

Fig. I is a schematic drawing of an air conditioning unit embodying one form of the present invention,

Fig. II is a view similar to Fig. I of another form of the invention, and

Fig. III is a schematic drawing of a system involving the present invention.

Referring to Fig. I, the air conditioning unit 10 has an air inlet 12 from which the entering air passes up through the filter 14. The fan 16 has a suitable drive shaft 18 upon which the fan elements are mounted. After leaving the fan 16, the air passes through the coil 20 and leaves the unit 10 by the outlet 22.

Chilled water flows to the coil 20 through the pipe 24 and it is returned to the water chiller 25 by the return pipe 26.

Condensate formed upon the coil 20 drips into the inclined pan 28 and runs into the accumulator 30. A ball or other suitable valve causes the condensate to collect in the accumulator 30 until the ball is floated from the seat 32 whereupon the pump 34 discharges the condensate from the accumulator 30 into the chilled water return line 26, through the line 36 and past the check valve 38. As shown, the pump 34 is driven by a belt 40 passing over a suitable pulley on the drive shaft 18. A suitable electric motor 42 directly connected to the shaft 18 and located on the back side of the fan 16 functions to drive both the fan 16 and the pump 34.

The condensate discharged into the chilled water return line 26 will supply any make-up water required. Any surplus will be elevated in the stand pipe 44 and discharged into the drain 46 which is preferably common to all the units 10 of the system.

In the form shown in Fig. II, a venturi 48 in the chilled water return line 26' performs the function of the pump 30 of Fig. I. Condensate from the unit 10 is discharged by the line 50 into the screen 52 in the upper end of the U-shaped stand pipe accumulator and trap 30'. The reduced pressure produced by the venturi 48 at 52 will maintain the liquid levels indicated to seal against the entrance of air into the return line 26'. The sensitive ball valve 54 permits the flow of condensate into the line 26' as it flows into the accumulator 30' yet prevents leakage which might result from a back pressure.

It is anticipated that the principles of the invention have application to refrigerating systems in which the cooling medium is other than chilled water. With a medium of a different substance than water, separation of the condensate from the cooling medium would be necessary at a central point.

Having thus described our invention, what we wish to claim as new and desire to cover by Letters Patent is:

A chilled water air conditioning apparatus comprising a cabinet, a body of cooling coils disposed in said cabinet, inlet and return conduits for conducting the chilled water to and from said coils, said body being inclined downwardly from one side of said cabinet toward the other side of said cabinet, means located below said body adjacent said other side of said cabinet for gathering condensate dripping from said coils, a valved accumulator disposed below said means, a pump having inlet connection with said accumulator disposed below said accumulator adjacent said other side of said cabinet and having a driven shaft, an outlet connection extending from said pump and discharging condensate into one of said conduits, an air circulating fan disposed in a lower portion of said cabinet adjacent said one side thereof and beside said pump and having a driven shaft parallel to said pump shaft, and a drive belt drivingly interconnecting said fan shaft and pump shaft.

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USP 4,696,340

United States Patent [19]

Nagao et al.

[11] Patent Number: 4,696,340

[45] Date of Patent: Sep. 29, 1987

[54] AIR CONDITIONER

[75] Inventors: Teruyuki Nagao; Yuji Kawamura; Koichi Kashima, all of Konan, Japan

[73] Assignee: Diesel Kiki Co., Ltd., Tokyo, Japan

[21] Appl. No.: 882,529

[22] Filed: Jul. 7, 1986

[30] Foreign Application Priority Data

Jul. 8, 1985 [JP] Japan 60-149625

[51] Int. Cl.[4] F25B 29/00

[52] U.S. Cl. 165/58; 62/325; 62/408

[58] Field of Search 236/13; 62/408-411, 62/325; 98/31.6; 165/96, 58

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Primary Examiner—William E. Tapolcai

Attorney, Agent, or Firm—Wenderoth, Lind & Ponack

[57] ABSTRACT

An air conditioner comprises an outer casing containing an inner casing having a heat exchanger disposed therein and a blower so as to define jointly with the inner casing an internal air intake passage. The air conditioner further includes an air intake-discharge selector mechanism disposed in a desired position in communication with the air intake passage for taking air into and out of the air conditioner.

5 Claims, 6 Drawing Figures

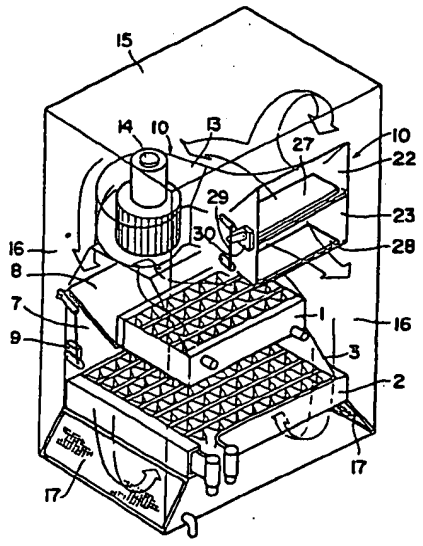

FIG. 2

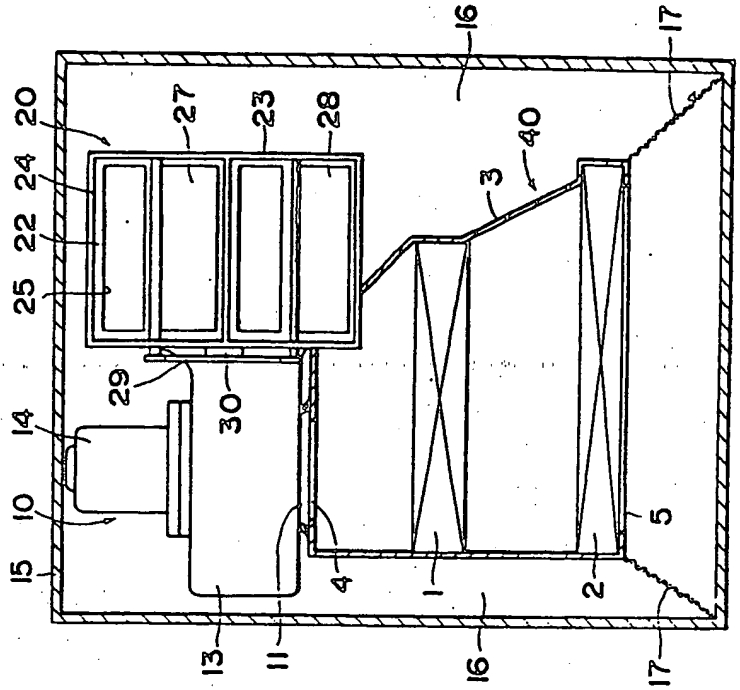
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FIG. 1

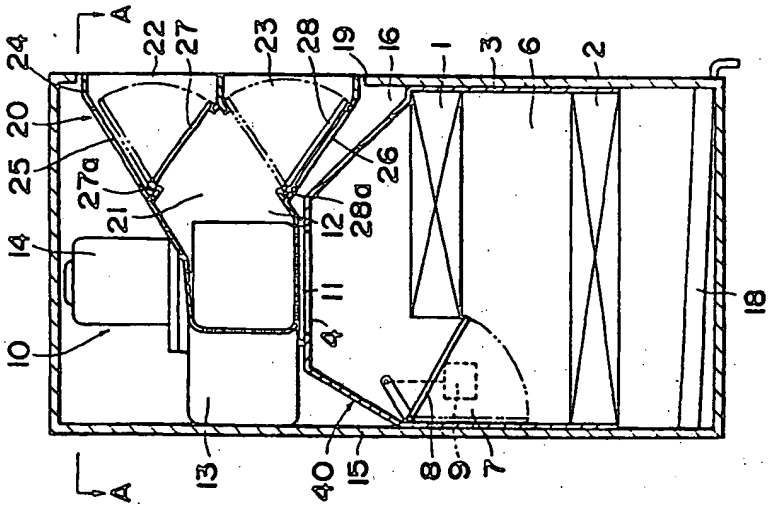
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FIG. 3

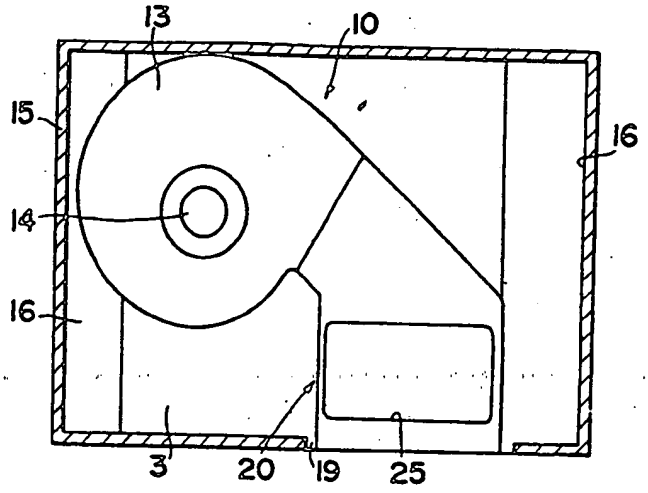
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FIG. 4

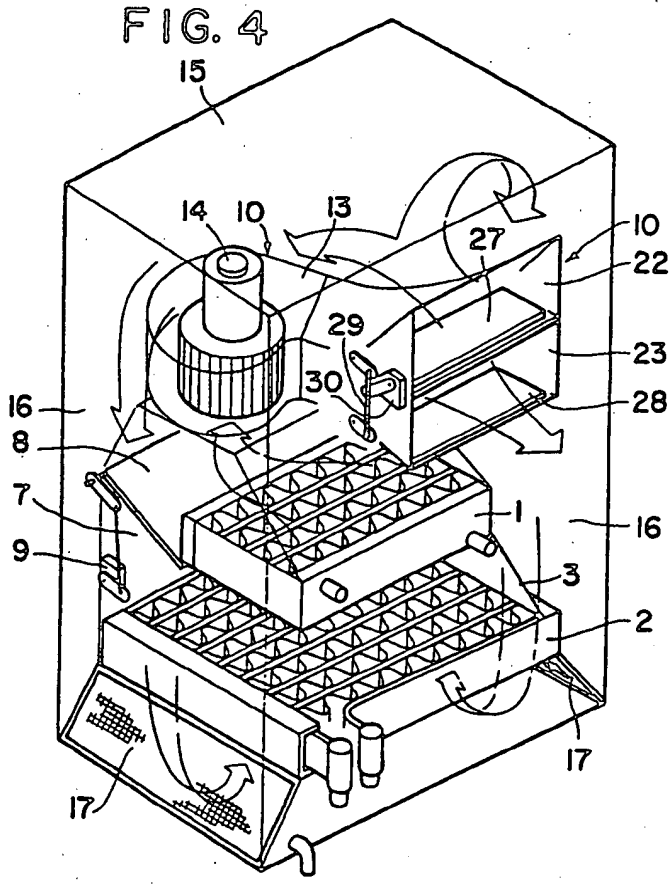
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FIG. 5

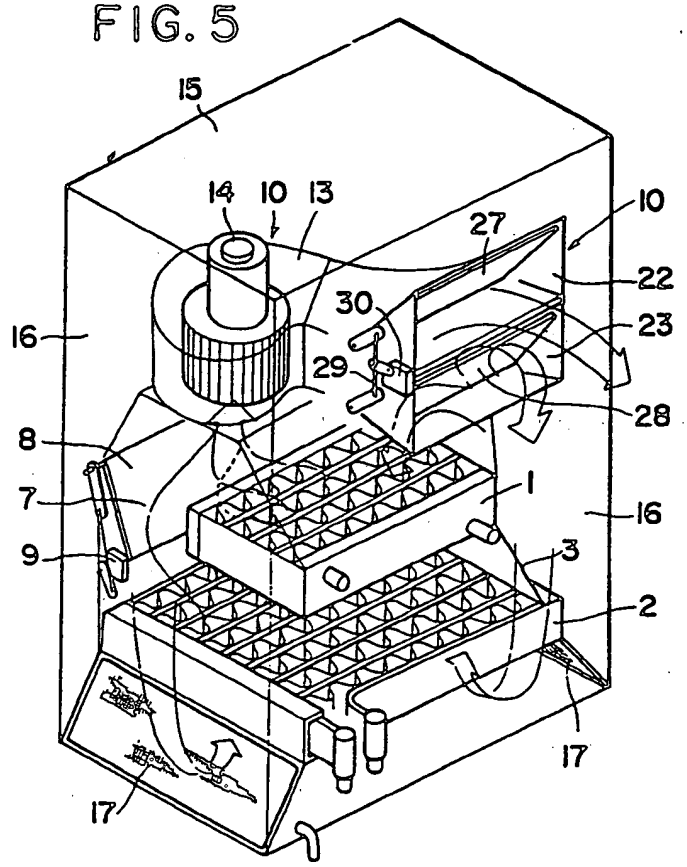
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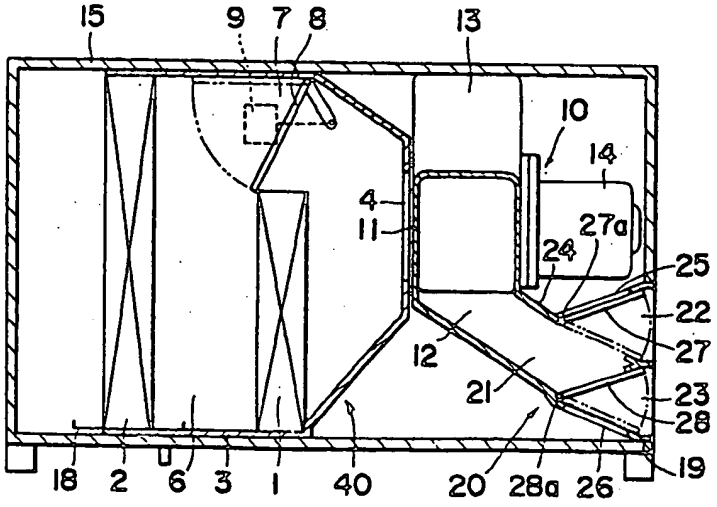
FIG. 6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AIR CONDITIONER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an air conditioner adapted to be installed in a building or a housing.

2. Prior Art

A conventional air conditioner disclosed in Japanese Utility Model Publication No. 44-29503 comprises a heat exchanger and a blower disposed in a casing or housing. Room air is introduced from a lower inlet into the casing for temperature control and the temperature-controlled air is blown from an upper outlet into the room interior. The airflow passage in the casing extends only in one direction so that the inlet must be disposed below the outlet.

With this construction, the air conditioner must be installed in a predetermined posture, i.e. an air conditioner having a construction for vertical installation cannot be installed in a horizontal posture or orientation. When the installation site has a space insufficient for vertical installation of such air conditioner, it becomes necessary to provide another air conditioner constructed to be suitable for horizontal installation thereof.

SUMMARY OF THE INVENTION

It is accordingly an object of the present invention to provide an air conditioner having versatility in respect to installation.

A more specific object of the present invention is to provide an air conditioner having structural features which enable the air conditioner to be installed in both vertical and horizontal postures without substantial reconstruction.

Another object of the present invention is to provide an air conditioner having inner and outer casings defining therebetween internal air intake passages having relatively large cross-sectional areas, respectively, thereby allowing air to flow therethrough at a low velocity.

A further object of the present invention is to provide an air conditioner capable of blowing conditioned air without causing unpleasant noise.

According to the present invention, the foregoing and other objects are attained by an air conditioner comprising an inner casing housing a heat exchanger therein, a blower disposed at one side of the casing and having a discharge hole connected with an air intake-discharge selector mechanism, an outer casing housing the inner casing and the blower therein so as to define jointly with the inner casing an internal air intake passage, the air intake passage being connected with the air intake-discharge selector mechanism.

With this construction, it is possible to dispose the air intake-discharge selector mechanism at any position, enabling the air conditioner to be installed either in a vertical posture or in a horizontal posture. Thus the air conditioner has a versatility in installation which facilitates adaptability in the installation of the air conditioner at a site having space limitations or restrictions.

Many other advantages, features and other objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description and the accompanying sheets of drawings in which preferred structural embodiments incorporating the principles of the present invention are shown by way of illustrative example.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical cross-sectional view of an air conditioner according to the present invention;

FIG. 2 is a view similar to FIG. 1, showing the air conditioner viewed from a different direction;

FIG. 3 is a cross-sectional view taken along line A—A of FIG. 1;

FIG. 4 is a schematic perspective view of the air conditioner illustrating airflow when the air conditioner is in a heating operation mode;

FIG. 5 is a view silimar to FIG. 4, showing airflow when the air conditioner is in a cooling operation mode; and

FIG. 6 is a cross-sectional view of an air conditioner according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIGS. 1 to 3, an air conditioner constructed in accordance with the present invention comprises an inner unit 40 having a heat exchanger 1 for heating, a heat exchanger 2 for cooling and an air-mix door 8, all the components 1, 2, 8 being disposed in an inner casing 3 of the inner unit 40. In the illustrated embodiment, the heat exchanger 1 is disposed above the heat exchanger 2.

The heat exchanger 1 receives circulating hot water for heating air as the latter passes through the heat exchanger 1. The heat exchanger 2 comprises an evaporator of a refrigeration system for cooling air as the latter passes through the heat exchanger 2.

The inner casing 3 has, at one of its opposite ends, an outlet 4 communicating with an intake hole 11 of a blower 10 and, at the other end, an inlet 5 which is substantially larger than the outlet 4. The inner casing 3 is fixed to an outer casing 15 at portions of the periphery of the inlet 5. The inner casing 3 includes therein a main airflow passage 6 extending upwardly from the inlet 5 to the outlet 4 through the heat exchangers 2, 1. The inner casing 3 further includes a bypass passage 7 extending around the heat exchanger 1 to bypass the same. The air-mix door 8 is disposed in the bypass passage 7 and is angularly movable to adjust the ratio of the amount of cooled air to the amount of heated air for controlling air temperature at a desired value. The air-mix door 8 is actuated by a motor actuator 9 driven in response to outputs from a control device or a manual temperature control lever (neither shown).

The blower 10 includes a blower casing 13 having the intake hole 11 and a discharge hole 12, a fan (not shown) movably disposed in the blower casing 13, and a drive motor 14 mounted on the casing 13 and coupled with the fan to rotate the latter. When the drive motor 14 is driven, air is drawn from the inner casing 3 through the outlet 4 and the intake hole 11 into the blower casing 13 and then is discharged from the discharge hole 12. The blower 10 is disposed above the inner casing 3 and is connected at an discharge side thereof with a air intake-discharge selector mechanism 20.

The outer casing 15 has a hollow rectangular body and houses therein the inner casing 3 and the blower 10. The outer casing 15, as shown in FIGS. 1 and 3, contacts the inner casing 3 at a pair of opposed inner faces thereof for supporting the inner casing 3. The

other pair of opposed inner faces of the outer casing 15 are separated from the inner casing 3 so that a U-shape internal air intake passage 16 is defined between the inner and outer casings 3, 15. The U-shaped internal air intake passage 16 communicates at its opposite ends thereof with the inlet 5 of the inner casing 3 which is open toward a lower end of the outer casing 15. Thus, air in the air intake passage 16 flows into the inner casing 3 through the inlet 5.

A pair of filters 17 extends diagonally between opposite lower corner edges of the inner casing 3 and opposed lower corner edges of the outer casing 15 for filtrating air passing therethrough. A drain pan 18 is disposed in the outer casing 15 at a lower end thereof for collecting condensed water.

The air intake-discharge selector mechanism 20 is comprised of a funnel-shaped selector duct or case 24 having an inner connecting opening 21 connected with the discharge hole 12 of the blower 10, and a pair of upper and lower outer openings 22, 23 communicating with the inner connecting opening 21 and facing the outside of the outer casing 15. The selector case 24 is formed integrally with the blower case 13.

The outer openings 22, 23 having a rectangular shape, are disposed one above another, and are fitted in an aperture 19 provided in the outer casing 15.

The selector case 24 of the air intake-discharge selector mechanism 20 further includes a pair of connecting passages 25, 26 through which the air intake passage 16 communicates with the interior of the selector case 24, and a pair of shutters 27, 28 pivotably mounted on respective support shafts 27*a*, 28*a* secured to the selector case adjacent to the inner connecting opening 21. The shutter 27 is movable between a first position indicated by phantom lines at which the connecting passage 25 is closed by the shutter 27 and the inner and outer openings 21, 22 communicate with each other, and a second position indicated by solid lines, at which the connecting passage 25 is open to and communicates with the outer opening 22. The shutter 28 is also movable between first and second positions indicated by phantom lines and solid lines, respectively. When the shutter 28 is in the first position, the connecting passages 26 is open to and in communication with the outer opening 23. Alternately when the shutter 28 is held in the second position, the connecting passage 26 is closed and the inner and outer openings 21, 23 communicate with each other.

The shutters 27, 28 are coupled with a lever 29 for synchronizing the angular movement of the shutters and are driven by a motor actuator 30. With the air intake-discharge selector mechanism 20 thus constructed, the discharge hole 12 of the blower 10 is connected with a selected one of the outer openings 22, 23 in response to pivotal movement of the shutters 27, 28. At the same time, the other opening 22 or 23 is in communication with the corresponding connecting passage 25 or 26.

Operation of the air conditioner is described below with reference to two operation modes respectively shown in FIGS. 4 and 5.

FIG. 4 shows the air conditioner functioning as a heater. In this operation mode, the shutters 27, 28 are held in the respective solid line positions of FIG. 1 so that heated air is blown from the lower outer opening 23 into the room interior. Room air is drawn into the air conditioner from the upper opening 22, which in turn enters the air intake passage 16 through the connecting passage 25, then flows downwardly along the inner casing 3, thereafter passes through the filters 17, and enters the inner casing 3 from the inlet 5. In the inner casing 3, the air flows upwardly through the heat exchanger 2 (not operated in the heating operation mode) and through the heat exchanger 1 during which time the air is subjected to a heat-exchange relationship with the hot water circulating through the heat exchanger 1.

The air thus heated is then drawn into the blower 10 through the outlet 4 and the intake hole 11, and thereafter is forced from the discharge hole 12 into the room interior through the inner and outer openings 21, 23 of the selector-mechanism 20. The temperature of the blown-off air is regulated by varying the angular position of the air-mix door 8.

The air conditioner shown in FIG. 5 is functioning as an air cooler. In this operation mode, the shutters 27, 28 are held in the phantom line position of FIG. 1 so that cooled air is blown from the upper outer opening into the room interior. Room air is drawn from the lower opening 23 into the air conditioner, which in turn enters the air intake passage 16 through the connector passage 26, then flows downwardly along the inner casing 3, thereafter passes through the filters 17, and enters the inner casing 3 from the inlet 5 thereof. In the inner casing 3, the air flows upwardly through the heat exchanger 2 where it is cooled. The cooled air further flows upwardly through the heat exchanger 1 (operated, if necessary, even in the cooling operation mode) and then is drawn from the intake hole 11 into the blower 10 through the outlet 4. The cooled air is then forced from the blower 10 into the room interior through the discharge hole 12 and the inner and outer openings 21, 22 of the selector mechanism 20.

To control the temperature of the blown-off air, the air-mix door 8 is turned to a desired angular position to regulate the amount of air passing through the heat exchanger 1.

FIG. 6 shows a modified air conditioner constructed for horizontal installation. This air conditioner is structurally and functionally the same as the air conditioner shown in FIGS. 1-5 with the exception that the air intake-discharge selector mechanism 20 is located in a different position. With this structural similarity, the same or corresponding parts are designated by the same reference characters and a detailed description is not necessary.

By providing two air intake-discharge selector mechanisms constructed exclusively for vertical and horizontal installation, respectively, an air conditioner can be installed in both vertical and horizontal postures without substantial reconstruction thereof.

Although in the illustrated embodiments, two heat exchangers 1, 2 are employed for controlling the air temperature, only one heat exchanger is necessary when the air conditioner is equipped with a heat pump. Furthermore, the air-mix door 8 may be replaced with any other suitable temperature control mechanism.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. An air conditioner comprising:

an outer casing;

an inner casing mounted within said outer casing and spaced therewithin from said outer casing for de-

fining an internal air intake passage between said inner casing and said outer casing; said inner casing having an inlet open to and communicating with said internal air intake passage, and said inner casing having an outlet;

at least one heat exchanger mounted within said inner casing between said inlet and said outlet thereof;

blower means having an intake hole open to and communicating with said outlet of said inner casing and a discharge hole, said blower means for drawing air thereto from said inner casing through said outlet of said inner casing and for forcing the air drawn thereto out of said discharge hole; and

an air intake-discharge selector mechanism within said outer casing for placing said discharge hole of the blower means in communication with the outside of the air conditioner while placing the outside of the air conditioner in communication with said internal air intake passage,

said air intake-discharge selector mechanism including a pair of outer openings extending through said outer casing thereby open to and communicating with the outside of the air conditioner, a pair of connecting passages each of which is open between a respective one of said outer openings and said internal air intake passage, a pair of shutters each of which is movably mounted over a respective one of said connecting passages for moving over and away from said connecting passages to respectively close and open said connecting passages thereby selectively communicating said outer openings with said internal air intake passage, and synchronizing means for moving one of said pair of shutters over the respective connecting passage thereof as the other of said pair of shutters moves away from the respective connecting passage thereof.

2. An air conditioner as claimed in claim 1,

wherein said at least one heat exchanger comprises a first heat exchanger for heating the air drawn through said inner casing by said blower means, and a second heat exchanger for cooling the air drawn through said inner casing by said blower means.

3. An air conditioner as claimed in claim 2,

wherein said inner casing has a main airflow passage defined therein between said inlet and said outlet and through which the air is drawn by said blower means;

said first heat exchanger is disposed within the inner casing in said main airflow passage;

said inner casing has a bypass passage extending around said first heat exchanger and therebetween and through which air drawn by said blower means bypasses said first heat exchanger; and

an air-mix door movably mounted in said bypass passage for opening and closing said bypass passage.

4. An air conditioner as claimed in claim 1,

wherein said internal casing has two opposed side faces and said outer casing has two opposed side faces, said two opposed side faces of said inner casing contacting said two opposed side faces of said outer casing respectively at respective inner surfaces thereof.

5. An air conditioner as claimed in claim 1,

and further comprising a filter extending between said inner casing and said outer casing.

* * * * *

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In an air conditioning unit, a part of air duct is formed by a dashboard panel (2), an instrument panel (3) and a supporting member (7) of an air conditioning unit. In the air conditioning unit, an evaporator (5) is disposed approximately horizontally.

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⑤4発明の名称　車両用空気調和装置

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明　細　書

1．発明の名称

車両用空気調和装置

2．特許請求の範囲

（1）熱交換器、送風機等の空調機構成要素をエアコンユニット支持部材に取り付け、該エアコンユニット支持部材を車体パネルに固定することで、該車体パネルと前記エアコンユニット支持部材とから通風ダクトを形成するようにしたことを特徴とする車両用空気調和装置。

（2）運転席側から助手席側に亘る車体幅方向に形成される横長型熱交換器、前記車体幅方向の回転軸を有し前記熱交換器の全幅に亘って送風可能なクロスフローファン等の空調機構成要素をエアコンユニット支持部材に取り付け、該エアコンユニット支持部材を前記車体のダッシュボードパネルとインストルメントパネルの適所に固定することにより、これらダッシュボードパネルとインストルメントパネル及び前記エアコンユニット支持部材とから通風ダクトを形成するようにしたことを特徴とする車両用空気調和装置。

（3）特許請求の範囲第2項記載の装置において、前記ダッシュボードパネルの少なくとも一部を前記クロスフローファンのスクロールとしたことを特徴とする車両用空気調和装置。

（4）特許請求の範囲第2項又は第3項記載の装置において、前記通風ダクトを形成する前記インストルメントパネルの所定箇所に空気吹出口を設けたことを特徴とする車両用空気調和装置。

3．発明の詳細な説明

（産業上の利用分野）

本発明は車両用空気調和装置に係り、特に該装置のケーシング構造の改善に関する。

（従来の技術）

第4図は従来の車両用空気調和装置を示し、(a)は車両に搭載した状態を示す全体斜視図、(b)は(a)のA－A線断面図を示す。従来の車両用空気調和装置はブロワーユニット(104)、クーラユニット(103)、ヒータユニット(105)等の各ユニットをダッシュボードパネル(102)やインス

トルメントパネル(103)によって区画成形された領域に断熱部材(114)を介して配設してなり、各ユニット(104),(100),(105)は夫々別個のユニットケース(104A),(100A),(105A)に収納されてなる。

このような空気調和装置には、冷却又は加熱された空気を通すための通風ダクトが構成されているが、従来の装置にあってはかかる通風ダクトは前記各ユニットケース内に設けられ、これらケースを連結することで構成するようにしている。

(発明が解決しようとする問題点)

しかしながらかかる従来の装置にあっては、前述したような各ユニットをダッシュボードパネルやインストルメントパネル等により区画形成された領域内に収納するに際し、各ユニットは夫々の機能に供した形状に形成されているため、これらを一つに結合してなるエアコンユニットの全体形状を前記区画形成された領域の形状に一致させることは困難であり、このため、どうしてもエアコンユニットとインストルメントパネル又はダッシュボードパネルとの間には不使用の無駄なスペースが残され、スペースの有効利用がなされない。

更にダッシュボードパネルやインストルメントパネル自体が一つのケースの一部を構成し得ることを考えれば、空気調和装置における各ユニットに夫々のユニットケースを持たせる必要はなく、従ってこの点より従来の装置はいわば二重壁構造を有することとなり、重量増大等の観点からも改善の余地がある。

そこで本発明はスペースの有効利用が図れ、軽量化にも優れた車両用空気調和装置を提供することを目的とする。

(問題点を解決するための手段及び作用)

この目的を達成するため本発明によれば、熱交換器(5),(8)、送風機(4)等の空調機構成要素をエアコンユニット支持部材(7)に取り付け、該エアコンユニット支持部材(7)をシール部材(21),(22)を介して車体パネル(2c)及びインストルメントパネル(3)に固定することで、該車体パネル(2c)及びインストルメントパネル(3)と前記エアコンユニット支持部材(7)とから通風ダクトを形成するようにする。

また、この目的を達成するため本発明によれば運転席側から助手席側に亘る車体幅方向に形成される横長型熱交換器(5),(8)、前記車体幅方向の回転軸(4a)を有し前記熱交換器(5),(8)の全幅に亘って送風可能なクロスフローファン(4)等の空調機構成要素をエアコンユニット支持部材(7)に取り付け、該エアコンユニット支持部材(7)を前記車体のダッシュボードパネル(2c)とインストルメントパネル(3)の適所に固定することにより、これらダッシュボードパネル(2)とインストルメントパネル(3)及び前記エアコンユニット支持部材(7)とから通風ダクトを形成するようにする。

このような構成によれば、ダッシュボードパネル、インストルメントパネルの一部を通風ダクトの一壁面として用いるため、従来のようなエアコンユニットケース(それ自体が通風ダクトを成す閉空間構造)が不要となる。

又、ダッシュボードパネル、インストルメントパネル、エアコンユニットケースの3者の協働により画成される横長の空間を通風ダクトとすることにより、エアコンユニットケース、或いはインストルメントパネルの任意の場所に、空気吹出口を開設することができるため、設計上の自由度が増し、空気吹出口までのダクト取廻しも最小限で済み(運転席側専用の吹出口用のダクト取廻しだけでよい)ため、ダクト全体としての通気抵抗が低減されることとなる。

更に、横長型クロスフローファンを用いることにより、横長型熱交換器の幅に送風可能となり、またフルスクロールケーシングを、ダッシュボードパネルによって形成することができるので、従来のシロッコファンのように、専用の別物スクロールケーシングを不要とし得る。

(実施例)

以下添付図面に従って本発明の実施例を説明す

る。なお、各図において同一の符号は同様の対象を示すものとする。

第1図は本発明の実施例に係る車両用空気調和装置を車両に搭載した状態で示す一部断面斜視図、第2図は各空調材構成要素をエアコンユニット支持部材に取り付けた状態を示す図である。図において、(1)は車体ボンネット、(2)はダッシュロアフロント(2a)、ダッシュアッパー(2b)、ダッシュロア(2c)からなるダッシュボードパネル、(3)はインストルメントパネルである。

エアコンユニットは空気流を形成するための送風機(4)、この送風機(4)の上流に存在し車幅方向に延在する例えばエバポレータなどの低温空気形成用の第1の熱交換器(5)、送風機(4)の下流に存在し同様に車幅方向に延在する例えばヒータコアなどの高温空気形成用の第2の熱交換器(6)を備えてなる。これら熱交換器(5)、送風機(4)、熱交換器(6)等の空調機構成要素は一つのエアコンユニット支持部材(7)に取り付けられ、エアコンユニット支持部材(7)はダッシュロア(2c)、インストルメントパネル(3)等の車体パネルに後述するようにシール部材を介して固定されている。

この実施例に係る車両用空気調和装置の全体は車幅方向に延在しており、更に詳しくは助手席前面のダッシュボードパネル内又はその後方で車体端部から運転席側中央部付近にかけて、送風機(4)及び熱交換器(5),(6)がそれぞれ配列してある。特に、送風機(4)は前記車幅方向に回転軸(4a)を有し、また熱交換器(5),(6)の延在長さにほぼ等しい長さのファン(4b)を回転軸(4a)の周囲に有する形のものであり、例えばクロスフローファンとして知られている。従って、この送風機(4)は、熱交換器(5)の低温空気を効率良く吸い上げて熱交換器(6)の通風面にこの低温空気を通過させる。熱交換器(6)は上下方向に多層に並なったヒータコア列(8a)の例えば1つ置きにダンパ(6b)を有する。このダンパ(6b)は、例えばヒータコア列(31)の通風面の面積とほぼ等しい面積の遮蔽板であり、その開度を調整することにより低温空気に対する高温空気の混合割合を制御することができる。なお、このダンパ(6b)の開度の制御は、車内温度や車外温度など各種のパラメータに基づいて自動的に行うようになっている。

エアコンユニット支持部材(7)は底部となる基部(8)とこの基部(8)の両側を支持する両側部(9)とからなる。前記基部(8)は車両フロア方向に延出され該フロアと略平行な平面部(10a)を有する第1の延出部(10)と、この延出部(10)の基端部(10c)より送風機(4)方向に延出する第2の延出部(11)と、同基端部(10c)より車両後方に延出され、その先端縁部(12b)がインストルメントパネル(3)の下端部(3a)にシール部材(22)を介して取り付けられた第3の延出部(12)からなる。また前記両側部(9)は第1、第2の熱交換器(5),(6)の両側端部を夫々不図示のシール部材を介して支持するとともに送風機の両端部をファンモータ(13)により回転可能に支持する。そして両側部(9)の両縁部(9a)にはダッシュアッパー(2b)、インストルメントパネル(3)等の車体パネルがその形状に沿って取り付けられるとともに第1、第3の延出部(10),(12)両側縁部が夫々シール部材を介して取り付けられ、更に前記第1の延出部(10)とダッシュロアー(2c)との間にはこれらの間を開閉するダンパ(21)がダッシュロアー(2c)側に揺動可能に設けられている。ここで、前記送風機(4)の取り付けに際して、送風機(4)は第2の延出部(11)の先端部付近であって当該送風機(4)の上方及び前方近傍には段状に形成されダッシュアッパー(2b)及びダッシュロアー(2c)の裏面が臨むように設けられる。このダッシュアッパー(2b)及びダッシュロアー(2c)の裏面にはシート状の断熱部材(14)が付設されている。又、前記第1の熱交換器(5)は送風機(4)の下方であって、前記第1、第2の延出部(10),(11)の間から前記ダッシュロアーの開口(20)上端縁にかけて設けられ、更に第2の熱交換器(6)は送風機(4)の後方であって、基部(10c)より前記ダッシュアッパー(2b)にかけて第3の延出部(12)と直交すべく立設され、各熱交換器(5),(6)と基部(8)、及び各熱交換器(5),

(6)とダッシュアッパー(2b)及びダッシュロア(2c)との間には夫々シール部材(15),(16)が介在される。尚、インストルメントパネル(3)の上面部とダッシュアッパー(2b)との間にはシール部材(17)が介在されている。

以上の構成において送風機(4)により車両ボンネット(1)の開口(1a)より吸入された空気はダッシュロアフロント(2a)及びダッシュアッパー(2b)及びダッシュロア(2c)表面から形成される通路を流れ、ダッシュロア下部に設けた外気導入口(20)より第1の熱交換器(5)→送風機(4)→第2の熱交換器(6)へと流れ、インストルメントパネル(3)正面に設けたアウトレット(18)より車室内に流れ、ダッシュロアフロント(2a)、ダッシュアッパー(2b)、エアコンユニット支持部材(7)、インストルメントパネル(3)等は空気調和装置の通風ダクトを構成することとなる。そして特に段状をなすダッシュアッパー(2b)及びダッシュロア(2a)の裏面は送風機(4)のスクロールとしても作用し、又インストルメントパネル(3)及び第3の延出部(12)は調和空気を形成するエアミックスチェンバとして作用する。そしてインストルメントパネル(3)上面及び第3の延出部(12)には夫々開口(25),(26)及びダンパ(27),(28)を設けフロントガラス(29)及び足下への送風を必要に応じて可能としている。

第3図は本発明により構成されるエアミックスチェンバを示した一部斜視図である。前述したようにインストルメントパネル(3)及びエアコンユニット支持部材(7)（第1図、第2図参照）から構成されるエアミックスチェンバは運転席側と助手席側へ調和空気を送出する吹出口(10)を有し、各吹出口(10)への空気流を相互に分割する仕切板(19)を備えている。すなわち、本実施例によれば、仕切板(19)は、運転席側センタアウトレット(18a)と助手席側センタアウトレット(18b)との間を分割しており、このアウトレット(18a),(18b)の上流のエアミックスチェンバ内の空間及び熱交換器(6)を運転席側と助手席側とで分割するように伸長している。

このような構成により、本実施例では運転席側と助手席側とで、例えば熱交換器(6)のダンパ(6b)を別個に制御することにより、調和空気の温度を独立に調節するようにしている。

（発明の効果）

本発明によれば以上のようにダッシュボードパネル、インストルメントパネルの一部を通風ダクトの一壁面として用いるため、従来のような別体であるエアコンユニットケーシング（それ自体が通風ダクトを成す閉空間構造）が不要となり、合理化、低価格化を図ることができる。又、ダッシュボードパネル、インストルメントパネル、エアコンユニット支持部材の三者の組合により画成される最長の空間を通風ダクトとすることにより、エアコンユニットケース、或いはインストルメントパネルの任意の場所に空気吹出口を設置することができるため、設計上の自由度が増し、空気吹出口までのダクト取回しも最小限で済む（運転席側専用の吹出口用のダクト取回しだけで済む）ため、ダクト全体としての通気抵抗が低減されることとなり、従って送風用のファンモーターの小型化、低回転化による静音化を図ることができるとともに、インストルメントパネル及びエアコンユニット支持部材からなるエアミックスチェンバを大きくとることができ、均一な吹出、安定した風速を任意に得ることができる。更に又最長径クロスフローファンを用いることにより、最長径熱交換器の幅に送風可能となり、またスクロールケーシングを、ダッシュボードパネルによって形成することができるので、従来のシロッコファンのように、専用の別体スクロールケーシングを不要とし、設計上の自由度向上に寄与することができる。

4．図面の簡単な説明

第1図は本発明の実施例に係る車両用空気調和装置を車両に搭載した状態で示す一部断面斜視図、第2図は各空調構成装置をエアコンユニット支持部材に取り付けた状態を示す図、第3図は本発明により構成されるエアミックスチェンバを示した一部斜視図、第4図は従来例を示す図であ

る。

そして図面中、(1),(2),(3)は車体パネルで(1)は車両ボンネット、(2)はダッシュボードパネル、(3)はインストルメントパネル、(6)は送風機（クロスロールファン）、(5),(6)は熱交換器、(14)は断熱部材、(21),(22)はシール部材、(18)はアウトレットである。

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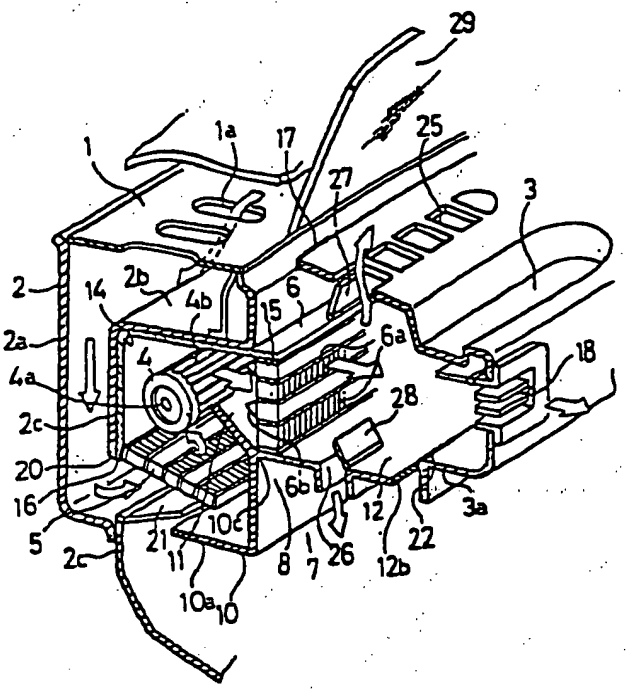
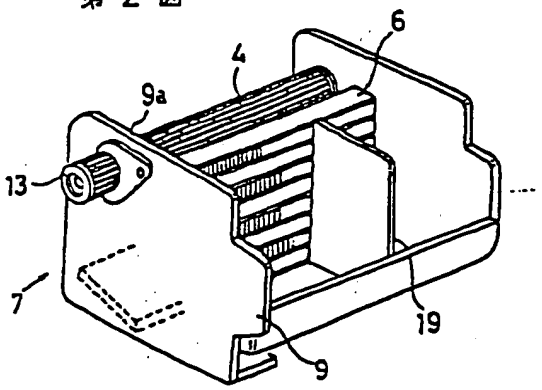
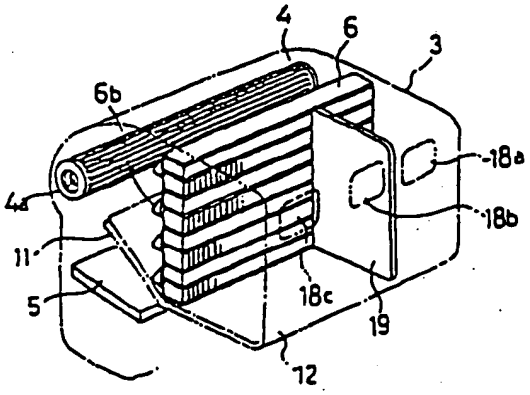
第1図



第2図



第3図



第4図

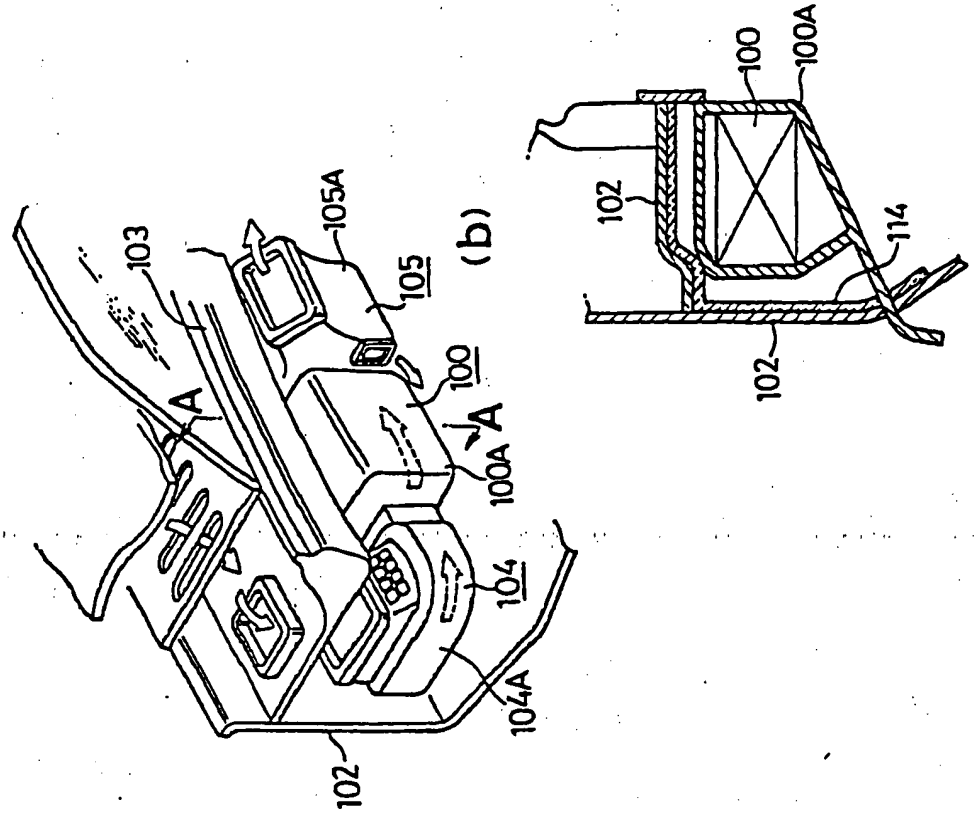


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FIG. 1 is a partially sectional perspective view showing a state where a vehicle air conditioning unit according to an embodiment of the present invention is equipped in a vehicle. FIG. 2 is a perspective view showing a state where components constructing the air conditioning unit are respectively attached to an air-conditioning-unit supporting member. In FIGS. 1, 2, a numeral (1) indicates a vehicle hood, a numeral (2) indicates a dashboard panel composed of a dashboard front (2a), a dashboard upper (2b) and a dashboard lower (2c), and a numeral (3) indicates an instrument panel.

The air conditioning unit has a blower (4) for generating air flow, a first heat exchanger (5) such as an evaporator for generating low-temperature air, and a second heat exchanger (6) such as a heater core for generating high-temperature air. Here, the first heat exchanger (5) is disposed at an upstream side of the blower (4), and is extended in a vehicle width direction. Further, the second heat exchanger (6) is disposed at a downstream side of the blower (4), and is extended in the vehicle width direction. The components of the air conditioning unit, such as the blower (4) and the first and second heat exchangers (5), (6), are attached to the single air-conditioning-unit supporting member (7). The air-conditioning-unit supporting member (7) is fixed to the vehicle panel such as the dashboard lower (2c) and the instrument panel (3) via a seal member, as described later.

The entire air conditioning unit according to the present

embodiment is extended in the vehicle width direction. Specifically, the blower (4) and the first and second heat exchangers (5), (6) are respectively disposed in or behind the dashboard panel at a front side of an assistant front seat from a vehicle side-end to an approximately center portion of a driver's seat side. The blower (4) has a rotation axis (4a) in the vehicle crosswise direction, and has a fan (4b) having a length approximately equal to the extension length of the first and second heat exchangers (5), (6) around the rotation axis (4a). For example, the blower (4) is one known as a cross flow fan. Accordingly, the blower (4) effectively sucks low-temperature air passing through the first heat exchanger (5), and makes the low-temperature air pass through the second heat exchanger (6). The second heat exchanger (6) has dampers (6b) on alternate layers of heater core rows (6a) stacked in an up-down direction in plural layers, for example. Each damper (6b) is a shield plate having an area approximately equal to an air passing area of each heater core row (6a), for example. Then, the mixture ratio of the high-temperature air to the low-temperature air can be controlled by adjusting an opening degree of the damper (6b). Here, the opening degree of the damper (6b) is automatically controlled based on each parameter such as compartment temperature inside a passenger compartment and outside temperature outside the passenger compartment.

The air-conditioning-unit supporting member (7) is composed of a base portion (8) as a bottom portion, and both side portions (3) supporting both sides of the base portion (8). The base portion (8) is composed of a first extension portion (10) having a flat portion

(10a) extended in a vehicle floor direction and approximately parallel to the vehicle floor, a second extension portion (11) extended from the base end portion (10c) toward the blower (4), and a third extension portion (12) extended from the base end portion (10c) toward a vehicle rear. Here, a leading edge portion (12b) of the third extension portion (12) is attached to a lower end portion (3a) of the instrument panel (3) through a seal member (22). Further, both side portions (3) support the first and second heat exchangers (5), (6) through seal members (not shown), respectively, and support both ends of the blower so that the fan can be rotated by a fan motor (13). Side end portions of the vehicle panels such as the dashboard upper (2b) and the instrument panel (3) are attached to a circumferential portion (3a) of the both side portions. Further, side end portions of the first and third extension portions (10), (12) are attached to the circumferential portions (3a) through seal members, respectively. Furthermore, a damper (21), for opening and closing an opening between the first extension portion (10) and the dashboard lower (2c), is provided therebetween at the side of the dashboard lower (2c) so as to be slidable. Here, the blower (4) is provided so that the back surfaces of the dashboard upper (2b) and the dashboard lower (2c), formed in a step shape around the leading edge portion of the extension portion (11) and above and in front of the blower (4), are opposite to each other. Sheet shaped heat-insulating members (14) are provided on the backs of the dashboard upper (2b) and the dashboard lower (2c). Further, the first heat exchanger (5) is provided under the blower (4) from a position between the first and second extension portions (10), (11) to an upper

end of an opening of the dashboard lower (2c). The second heat exchanger (6) is provided at the back of the blower (4) from the base portion (10c) to the dashboard upper (2b) so as to be perpendicular to the third extension portion (12). Seal members (15), (16) are provided between the heat exchangers (5), (6) and the base portion (8), between the heat exchangers (5), (6) and the dashboard upper (2b), and between the heat exchangers (5), (6) and the dashboard lower (2c), respectively. Further, a seal member (17) is provided between an upper end portion of the instrument panel (3) and the dashboard upper (2b).

In the above-described construction, air sucked from an opening (1a) of the vehicle hood (1) flows in a passage formed by surfaces of a dash lower front (2a), the dashboard upper (2b) and the dashboard lower (2c). Then, the air flows from an outside-air introduction port (20) provided at a lower portion of the dashboard lower (2c) to the following route: the first heat exchanger (5) → the blower (4) → the second heat exchanger (6). Then, the air flows from an outlet (18), provided on a front surface of the instrument panel (3), into the passenger compartment. That is, the dash lower front (2a), the dashboard upper (2b), the dashboard lower (2c) and the like constitute an air duct of the air conditioning unit. Further, the back surfaces of the dashboard upper (2b) and the dashboard lower (2c), provided in a step shape, also operate as a scroll of the blower (4), and the instrument panel (3) and the third extension portion (12) also operate as an air mixing chamber for generating conditioned air. On the upper surface of the instrument panel (3) and the third extension portion (12), openings (25), (26) and dampers (27), (28)

are provided, respectively, so that air can be also blown toward a windshield (29) and feet of a passenger in accordance with a request.

FIG. 3 is a partially detailed view showing an air mixing chamber according to the present invention. As described above, the air mixing chamber, constructed of the instrument panel (3) and the air-conditioning-unit supporting member (7) (refer to FIGS. 1, 2), has air ports (18) through which air is blown to the driver seat side and the assistant seat side, and a partition plate (19) for partitioning air flow toward both air ports (18). In the present embodiment, the partition plate (19) partitions a driver-seat-side center outlet (18a) and an assistant-seat-side center outlet (18b), and is extended so as to respectively partition a space within the air mixing chamber and the heat exchanger (6) upstream of the outlets (18a), (18b).

In such construction according to the present embodiment, temperature of conditioned air is independently controlled at the driver seat side and the assistant seat side, for example, by individually controlling the dampers (6b).

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COOLER FOR REFRIGERATORS

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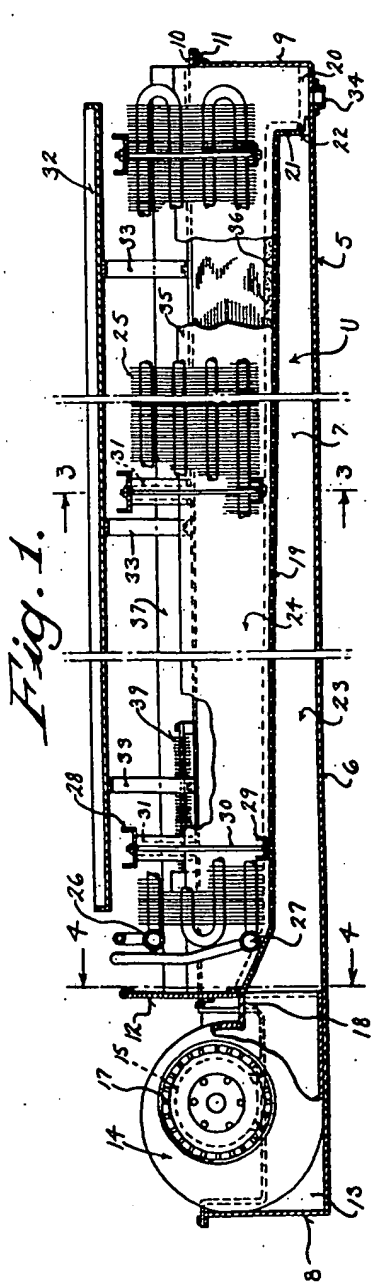

Fig. 1.

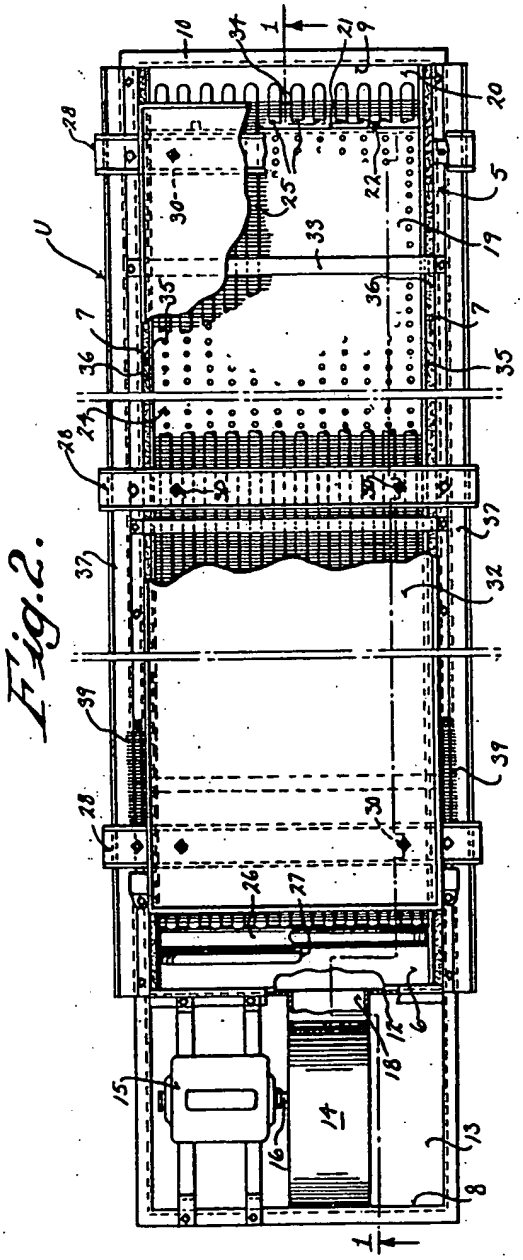

Fig. 2.

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Fig. 3.

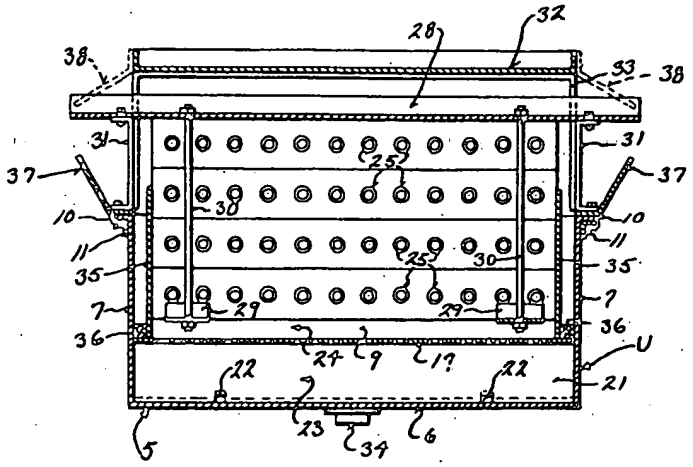
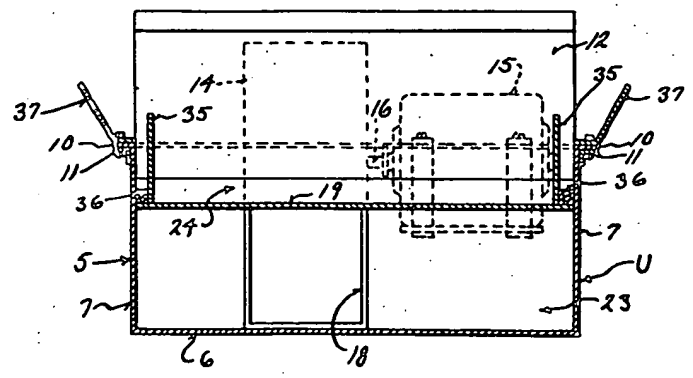


Fig. 4.



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COOLER FOR REFRIGERATORS

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Application March 10, 1954, Serial No. 415,244

3 Claims. (Cl. 257—9)

This invention appertains broadly to refrigeration, and more particularly to a novel air conditioning unit for use in meat coolers, chill and boning rooms, etc., and is an improvement on our Patent No. 2,132,985 issued October 11, 1938.

One of the primary objects of our present invention, is to provide novel means for insuring a uniform and full volume of air flow past the cooling units throughout the entire length of the refrigerating unit, whereby to insure the proper distribution of cool air at a desired uniform temperature into the room.

Another salient object of the invention is to provide an air conditioning unit including an elongated body housing or shell divided into a lower air pressure chamber and an upper air flow and distributing chamber by a novelly disposed perforated baffle plate, with means including a motor driven blower for supplying air at the desired volume rate of flow to one end of the air pressure chamber, the baffle plate being so formed and arranged that the flow of air therethrough will be equal from the blower to the opposite end of the unit without objectionable air eddies and dead spots.

A further object of the invention is to permit the unobstructed flow of air from the blower to the air pressure chamber and to dispose the air equalizing baffle plate at an angle to the horizontal and at a gradual incline downward from the blower to the opposite end of the unit, so that the incoming air will impinge against the lower surface of the baffle and be directed through the openings thereof, and whereby the air will be gradually restricted at the far end of the pressure chamber from the blower to insure the flow of air through the baffle plate equally, from one end thereof to the other.

A further important object of the invention is to utilize the baffle plate as a water (condensation) flow plate, so as to insure the washing and humidifying of the air as the same passes through the openings in the baffle plate and thereby effectively preserve the color of the meat and to prevent excessive shrinkage in the meat.

Another further object of our invention, is to provide imperforate baffle plates on the opposite sides of the cooling coils in spaced relation to the side walls of the body housing and extending above the side walls, whereby to prevent the formation of ice and condensation on the side walls and to direct the cool air out above the side walls.

A still further object of the invention is to provide a top wall for the unit for directing the air outward in the nature of a pan for collecting water of condensation and to provide side inclined baffle plates in connection therewith for either directing the cold humidified air up or down as may be desired in a particular installation.

Another still further important object of the invention is the provision of electric heater means associated with the unit at predetermined points, adapted to be brought into use at desired times for humidity control.

With these and other objects in view the invention consists in the novel construction, arrangement and formation of parts as will be hereinafter more specifically described and claimed, and illustrated in the accompanying drawings, in which drawings,

Figure 1 is a longitudinal sectional view through our improved cooler for refrigerating and like rooms, the section being taken on the line 1—1 of Figure 2, looking in the direction of the arrows;

Figure 2 is a top plan view of our unit, parts of the

view being shown broken away to illustrate structural detail;

Figure 3 is a transverse sectional view through the unit taken on the line 3—3 of Figure 1, looking in the direction of the arrows and showing the arrangement of the cooler units and side baffle plates, and

Figure 4 is a view similar to Figure 3, but taken on the line 4—4 of Figure 1, the view showing the unobstructed inlet for the air leading into the pressure chamber from the blower.

Referring to the drawings in detail, wherein similar reference characters designate corresponding parts throughout the several views, the letter U generally indicates the complete unit and the same includes an outer body housing or shell 5, preferably formed from metal, such as stainless steel, which will resist rust. This body housing includes a bottom wall 6, spaced parallel side walls 7, and end walls 8 and 9. The upper edges of the walls 7, 8 and 9 are provided with outwardly extending marginal flanges 10 to reinforce and strengthen the housing and to provide attaching means for certain parts of the unit as will be later brought out. If desired angle iron frame members 11 can be secured to the walls 7 and 9 under the flanges 10 to add additional strength and rigidity to the unit.

Arranged within the body housing adjacent to the end wall 8 is a transverse partition 12, which preferably extends above the side walls 7, and this partition in conjunction with the end wall 8 forms a compartment 13. Arranged within the compartment 13 is the blower 14 and its electric drive motor 15. The armature shaft 16 of the motor is directly connected to the shaft of the fan 17 of the blower. In accordance with our improvements, the outlet throat 18 of the blower opens out straight through the partition plate 12, for a purpose which will also later appear and it is to be noted that this throat is unobstructed.

Arranged within the body housing 5 is a perforated air equalizing baffle plate 19. This baffle plate extends from one side wall 7 to the other and is rigidly secured to these walls by welding or the like, and the plate can be formed from stainless steel, if so desired. As best shown in Figure 1, the baffle plate extends from the partition wall 12 toward the end wall 9 and the baffle plate terminates slightly short of this end wall 9 to provide a drain sink 20. The plate 19 has its end just adjacent to the wall 9 bent down into engagement with the bottom wall 6 of the body housing to form an end wall 21, and this end wall is provided with drain openings 22 which communicate with the drain sink 20. The end of the wall 19, which is adjacent to the partition wall 12, is bent up and secured to this partition directly above the outlet throat 18 of the blower. The arrangement of the baffle plate 19 is such as to form a lower pressure chamber 23 and an upper air flow and distributing chamber 24. One of the important features of the present invention, is the fact that we incline the baffle plate 19 downwardly from the blower toward the end wall 9, and this feature will be later discussed.

Arranged within the upper air flow and distributing chamber 24 are the finned cooling coils 25, and these coils extend from one end of the chamber to the other. The coils are provided with inlet and outlet headers 26 and 27 with which inlet and outlet pipes communicate for permitting the circulation of the refrigerating liquid through the coils. The cooling coils are arranged above the perforated equalizing baffle 19 and the coils extend the full length of this plate. The cooling coils 25 can be held in the chamber 24 in any desired manner, and in the present showing upper and lower channel clamp bars 28 and 29 are provided, and these bars are held together on the coils by vertical tie rods 30. The top channel bars 28 constitute the supporting means for the cooling coils and these bars extend beyond the walls 7 of the body housing 5 and are secured to the side walls by brackets 31. These brackets are bolted or otherwise secured to the flanges 10 on the side walls 7.

Forming the top of the unit is a top wall deflector plate 32 and this plate can be in the nature of a pan for the collection of water of condensation. The deflection plate is held in proper spaced relation to the coils

25 and the side walls 7 by means of inverted U-shaped brackets 33, which extend transversely across the unit with the lower ends thereof secured to the flanges 11 of the side walls.

In use of the unit, the same is secured in place at the proper point to the ceiling of a chill or cold room, by suspension hangers (not shown), and as condensation collects in the unit, the same drips from the coils onto the baffle plate 19. Air flowing through the openings in the baffle plate 19 from the pressure chamber 23 into the chamber 24 is washed and humidified by the water. Surplus water flows down the inclined baffle plate 19 into the sink 20, and a drain pipe 34 can be provided for carrying this surplus water off to a sewer. If desired, an additional drain pipe (not shown) can be provided for the chamber 23 adjacent to the wall 21.

In conjunction with the top deflector plate 32 we utilize side wall deflector or baffle plates 35. These side wall deflector or baffle plates 35 are secured to the upper surface of the baffle plate 19 and extend from the partition 12 to the end wall 9 in slightly spaced relation to the side walls 7 of the body housing. Combination insulator and spacer strips 36 are disposed between the lower ends of the deflector or side baffle plates 35 and the upper end of the baffle plates extend above the upper edges of the walls of the body housing. The side plates 35 not only direct the air upwardly and then outwardly, but also form a space between the chamber 24 and the side walls 7 to prevent the frosting up of these side walls 7 and the accumulation of moisture thereon.

Longitudinally extending outwardly angled louvers 37 are also provided, and as shown in Figures 3 and 4, these louvers are directed upwardly and outwardly and are secured to the flanges 10 on the side walls 7. These louvers are used to direct the air upwardly and against the ceiling of a room where it is again distributed and deflected downwardly. If so desired, and as suggested in dotted lines in Figure 3, "down" louvers 38 can be provided and these louvers can be carried by the longitudinal side edges of the top deflector plate 32. In this instance, the louvers 38 direct the air downward.

Now considering that the unit is properly positioned in the room with the blower 14 functioning; then the air from the blower enters straight into the pressure chamber 23 and due to the inclination of the baffle plate 19, the air strikes the lower surface of the baffle plate and is directed through the openings into the baffle plate, into the chamber 24 past the coils 25 and out of the sides of the unit. As the chamber 23 decreases in size toward the end wall 9, the air is gradually restricted as the same flows toward the end wall 9, and this restriction eliminates undesired air eddies and dead spots, and insures the upward flow of the air through the perforations and actually the flow of air is equal throughout the entire length of the baffle plate 19.

Electric heating elements 39 of a desired type can be placed on opposite sides of the unit in the air stream to regulate humidity and these heaters can be turned off and on as desired. The heaters can be bolted or otherwise fastened to the flanges 10 of the side walls 7. The heating elements 39 are of great importance, in that under certain conditions an excessive amount of moisture is present in the air. By utilizing the heaters, the air is somewhat dried and lightened to permit the free circulation thereof and the depositing of the moisture on the cooling coils.

Changes in details may be made without departing from the spirit or the scope of this invention, but what is claimed as new is:

1. An air conditioning and cooling unit for chill and like rooms comprising an elongated body housing having a bottom wall, spaced parallel side walls and end walls, a transverse partition in said body housing arranged adjacent to one end wall, an air equalizing and distributing baffle plate disposed in the housing extending from one side wall to the other and from the partition toward the remote end wall defining in said housing a lower pressure chamber and an upper air distributing chamber, said baffle plate being provided with perforations, a motor driven blower in said housing on the opposite side of the partition from the baffle plate having a straight outlet throat opening into the pressure chamber, said baffle plate also including an end wall engaging the bottom wall of the housing in spaced relation to an adjacent end wall and defining a water collection sink, a discharge pipe communicating with the sink, cooling coils within the upper chamber, a top deflector plate carried by the housing in spaced relation to the upper edges of the side walls and disposed above the cooling coils, and outwardly angled baffle plates disposed on opposite sides of the housing and cooling coils.

2. An air conditioning and cooling unit as defined in claim 1, and said air distributing baffle plate being inclined downwardly from the partition plate toward the opposite end of the housing.

3. An air conditioning and cooling unit as defined in claim 1, and electric heaters disposed between the top plate and the sides of the housing.

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USP 3,492,833

Feb. 3, 1970 K. E. MARSTELLER 3,492,833

AIR CONDITIONING

Filed May 22, 1968 2 Sheets-Sheet 1

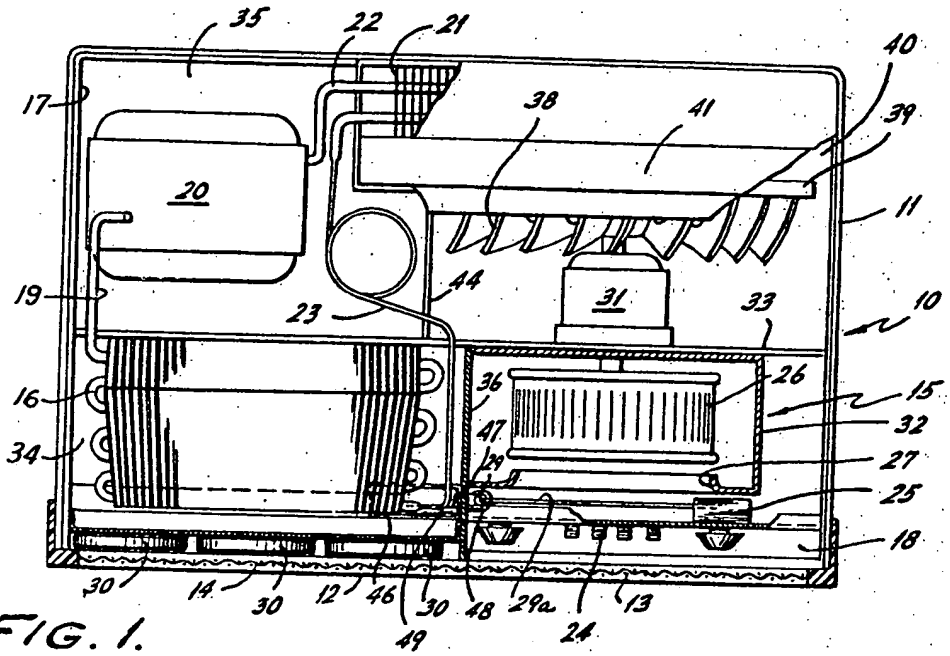

FIG. 1.

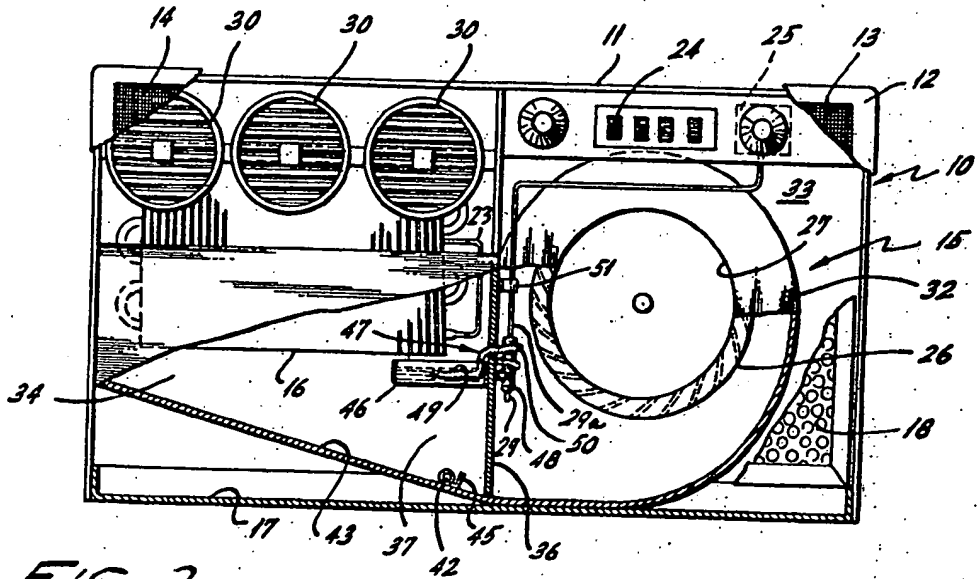

FIG. 2.

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AIR CONDITIONING

Filed May 22, 1968 2 Sheets-Sheet 2

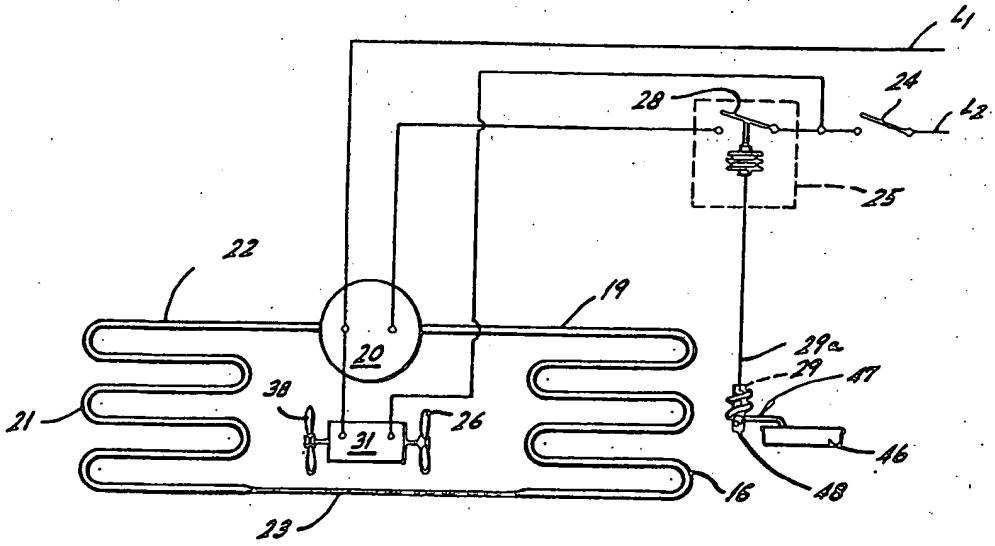

FIG. 3.

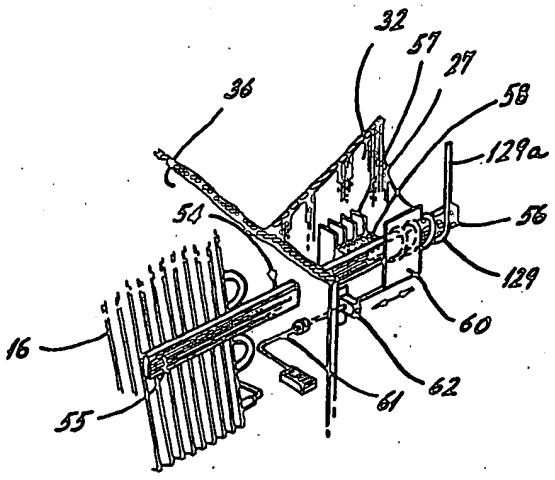

FIG. 4

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United States Patent Office 3,492,833 Patented Feb. 3, 1970

3,492,833

AIR CONDITIONING

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Filed May 22, 1968, Ser. No. 731,054
Int. Cl. F25d 17/04; F24f 1/02
U.S. Cl. 62—176 6 Claims

ABSTRACT OF THE DISCLOSURE

An air conditioner temperature control having a single, "dry bulb" thermostat that effects thermostatic control of the air conditioner compressor as a function of both temperature and humidity. The thermostat's sensing element is disposed in such heat exchange relation with a thermal conductor disposed in the stream of air undergoing control that the heat transferred by the conductor between the stream of air and the sensing element is a function of the moisture content of the stream of air. Operation afforded by the control is such that when the relative humidity is high, the air conditioner operates to maintain a lower dry bulb temperature than when relative humidity is low. Conversely, when the relative humidity is low, the air conditioner operates to maintain a higher dry bulb temperature than when the relative humidity is high.

BACKGROUND OF THE INVENTION

This invention relates to air conditioning, and more particularly to improvements in control means for air conditioning apparatus.

While of broader applicability, the present invention has particular utility in the field of single-room air conditioners. Such air conditioners generally are controlled by thermostats responsive only to the dry bulb temperature of the room air. Accordingly, the range of relative humidity may vary considerably during a cooling cycle. As is well known in the art, occupants of a rom will feel comfortable only so long as the combination of relative humidity and dry bulb temperature of the room air results in an effective temperature falling within the so-called "comfort-zone."

It is a general objective of this invention to provide simple and inexpensive air conditioner control means operable in response to effective temperatures, rather than only dry bulb temperatures, whereby air being conditioned will be maintained within the comfort zone.

SUMMARY OF THE INVENTION

In achievement of the foregoing as well as other objectives, the invention contemplates—particularly in an air conditioner—the combination of a thermostat including a sensing element, means for moving air, a thermal conductor positioned in heat exchange relation with both the sensing element and the air as it is caused to move, and means responsive to changes in the relative humidity of the air for varying heat transferred by the conductor from the air to the sensing element.

Advantageously, the invention involves simple but novel modification of thermostatic sensing element of well known type whereby an air conditioner can be made to achieve and maintain effective temperatures within the comfort zone.

The foregoing as well as other objectives and advantages of the invention will be more fully understood from a consideration of the following description, taken in light of the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIGURE 1 is a plan view, with parts removed and other parts broken away, of air conditioning apparatus embodying the present invention;

FIGURE 2 is a front elevational showing, partly in section and with parts broken away, of apparatus seen in FIGURE 1;

FIGURE 3 is a diagrammatic view illustrating a refrigerant flow circuit, and control means therefor embodying the invention; and

FIGURE 4 is a fragmentary showing of a portion of apparatus as seen in FIGURE 2, including another form of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With more detailed reference to the drawing, and first to FIGURES 1 and 2, the control apparatus of the invention is shown as embodied in a window-mounted air conditioner 10 including a cabinet or housing 11, preferably but not necessarily rectangular in configuration, having a base portion 17 and a conventional decorative panel 12. The latter has room air inlet and outlet passage means for the air moving means to be described more fully in what follows. The inlet includes grille 13 and a filter 18 disposed in the right hand region of panel 12 and in air flow communication with the inlet opening 27 of indoor blower portion 26 of air moving means 15. The aforesaid outlet air passage means includes grille 14 disposed in air flow communication with an evaporator coil 16, hereinafter also referred to as the indoor coil. A plurality of independently rotatable louvers 30 are disposed between the evaporator coil 16 and outlet grille 14 and conveniently provide selectivity of the direction of discharge air flow. Evaporator coil 16, preferably of the finned type, is part of the usual refrigerating system, shown diagrammatically in FIGURE 3 and including a motor compressor 20, condenser or outdoor coil 21, and associated conduits through which said motor compressor, condenser and evaporator coils are coupled in series refrigerant flow circuit. These conduits include a line 22 through which refrigerant normally is delivered to outdoor coil 21, and a feed line 23 which, as shown, may advantageously comprise a continuously open restrictive connection through which liquified refrigerant is normally fed to the indoor coil 16 for expansion therein. Refrigerant is withdrawn by the compressor from the evaporator through suction line 19 to complete the refrigerant flow circuit. The compressor is selectively energized through lines L_1 and L_2 having in series therewith line control switch means 24 (see also FIGURE 2) and the switch 28 of a bellows-actuated thermostat 25 having a sensing bulb 29. In particular accordance with the invention, the bulb is arranged in a novel manner described below.

Referring again to air moving means 15, a motor 31 is connected to lines L_1 and L_2 (FIGURE 3), in series electrical circuit with line switch 24, and rotatably supports the blower 26 adapted to circulate air in heat exchange relation with evaporator coil 16. Blower 26 is housed within a scroll structure 32 disposed adjacent a partition 33 which divides cabinet 11 into an evaporator coil chamber 34 and a condensing coil chamber 35. The portion of cabinet 11 comprising chamber 34 is adapted to extend into a room or space to be air conditioned while chamber 35 of the cabinet, lying to the other side of partition 33, extends outwardly of the room, preferably through a window opening thereof. The evaporator coil chamber 34 is subdivided by means of a partition 36, into a section having disposed therein the blower and scroll assembly 26, 32 and a section in which is disposed evap-

orator coil 16. The mouth portion 37 of the scroll 32 extends through partition 36 and into position to direct air against one face of evaporator coil 16.

Condensing coil chamber 35 also has disposed therein motor compressor 20 and fan motor 31. A propeller type fan 38 is rotatably supported within chamber 35 by motor 31 to provide for drawing outside air into the chamber over the outdoor coil 21, and for discharging the spent air outwardly from the chamber over motor compressor 20.

The fan 38 includes a conventional condensate ring 39 which dips into a condensate sump 40 and causes condensate in the sump to be thrown onto baffle means 41 arranged to direct the condensate onto outdoor coil 21 for evaporation therefrom in the course of the refrigerating cycle. Condensate formed on the indoor coil drips onto a baffile 43 and flows through an opening 42 connected to a tube 44 terminating at sump 40. The evaporator coil element 16 is generally planar in configuration and is positioned to slope in such manner that condensate dripping therefrom falls substantially across the entire area of the evaporator and upon sloping baffle 43.

In especial accordance with the invention, a pan 46 conveniently supported from partition 36 is disposed below a portion of evaporator coil 16 to intercept and store a portion of the evaporator coil 16 to intercept store a portion of the condensate dripping therefrom. A wick 47 extends through a suitable opening (FIGURE 2) in partition 36. One end 49 of the wick extends into pan 46 for immersion in the condensate, and the other end 50 is coiled about a section of rubber tubing 48. Sensing bulb 29 extends into the bore of tubing 48, in close thermal engagement therewith and is held in position by suitable clamping means 51 conveniently supported from the partition 36.

By such arrangement, both the sensing bulb 29 and its non-sensing portion 29*a* will be subjected to the flow of room air as it is drawn through grille 13, filter 18, and the inlet 27 of blower 26. The section of rubber tubing 48 is characteristically of material affording a path of limited thermal conductivity between the sensing bulb 29 and the coiled wick portion 50. There is also a heat path between sensing bulb 29 and its non-sensing portion 29*a*. The sensing bulb 29 is subjected to dry bulb temperature by virtue of the above described disposition of portion 29*a*, and to wet bulb temperature by virtue of the wick portion 50 disposed about tubing 48 through which the bulb extends. In operation, the bulb portion 29*a* absorbs heat from the moving air, and serves as a conductor for transferring this heat to the relatively cold sensing bulb 29. Cooling of bulb 29 is ensured by the thermal path between it and wick portion 50, and the degree of such cooling is dependent upon the rate of evaporation from the wick as a function of the percent relative humidity thus, for a given dry bulb temperature the motor-compressor will be caused to operate a greater percentage of time when the relative humidity is higher than when it is lower. The net effect is thermostatic control of the air conditioner in a range representative of an effective temperature. By suitably balancing the thermal effects of wet and dry bulb temperatures, operation can be established and maintained so that the effective temperature falls within the comfort zone.

A modification of the invention is seen in FIGURE 4, wherein the sensing portion 129 of a control bulb 129*a*, similar to the described bulb, is coiled about a thermally conductive member 54 extending through partition 36. One end portion 55 of member 54 is disposed in the stream of air after its flow over evaporator coil 16, and the other end portion 56 is disposed in the stream of air prior to its flow over the evaporator coil. A set of heat exchange fins 57 are thermally coupled with the end portion 56 by means of a body 58 of hygroscopic material, such for example as activated alumina, also exposed to the stream of air prior to its flow over the evaporator. Thus, the end portion 55 is "cold-biased" by virtue of its disposition downstream of evaporator coil 16, and the conduction path to control bulb 129, by way of end portion 56, is in effect "short circuited" by the body of hygroscopic material 58 whose thermal conductivity is a function of the moisture content of air flowing thereover. The thermal conductivity of body 58 increases with increasing relative humidity, whereby flow of heat into the bulb 129 will be greater for such increased relative humidity. Conversely, thermal conductivity of body 58 decreases with decreasing relative humidity, whereby flow of heat into bulb 129 from the incoming air will be less for decreased relative humidity. By such arrangement, and for a given dry bulb temperature, the motor compressor will be caused to operate a greater percentage of time when the relative humidity is higher than when the relative humidity is lower. By suitably balancing the thermostat's cycling characteristics with the capacity of refrigerating unit, temperatures can be maintained within the comfort zone.

With further reference to FIGURE 4, the air conditioner is enabled to achieve an environment corresponding to a particular region of the comfort zone by regulating the relative influences of the dry bulb and the wet bulb temperatures. Regulation is achieved by means of an air shield 60 that may be selectively positioned to govern the amount of air flowing over control bulb sensing element 129. One arrangement for doing this comprises supporting shield 60 on a rod 61 that is longitudinally slidable through an opening in partition 36 and within a bracket 62. Movement of the shield may be achieved either manually, or by suitable linkage means, whereby the desired regulation may be achieved.

Advantageously, the described balancing arrangement achieves a more precise establishment and maintenance of a desired effective temperature. This will be more fully appreciated when it is realized that even though the effective temperature may be maintained within the comfort zone, complete subjective comfort is not necessarily achieved. The effective temperature range which embraces the comfort zone is a compromise, since such zone contemplates the comfort of most of the subjects, for example about 90%. The additional control afforded by apparatus illustrated in FIGURE 4 affords adjustment of the effective temperature range within the comfort zone in order to satisfy the needs of the remaining 10% of the subjects.

While only those operational elements necessary for an understanding of the invention have been disclosed, it will be appreciated that other conventional features may be included.

For example, the fan motor may be of the multi-speed type to afford varying degrees of air circulation. Also, dampers may be provided for mixing outside air with indoor air, as may be desired by the user.

I claim:

1. In combination, a thermostat including a sensing element, means for moving air over said sensing element, means for controlling the dry bulb and wet bulb temperatures of such air in accordance with temperatures sensed by said sensing element, said sensing element including a portion subjected to the dry bulb temperature of air flowing thereover and a portion subjected to the wet bulb temperature of air flowing thereover, and means for selectively balancing the effects of such dry and wet bulb temperatures on said sensing element.

2. In air conditioning apparatus of the type including a cooling coil and means for moving air over said cooling coil; a thermostat operable to control energization of said cooling coil and including a sensing element; a thermal conductor positioned in heat exchange relation with said sensing element, and further including portions positioned

both upstream and downstream of said cooling coil for heat exchange relation with air caused to flow over the latter; and means for providing variable thermal coupling between said conductor and the moving air, said last recited means being effective to vary the thermal coupling in accordance with changes in relative humidity of the moving air.

3. Apparatus according to claim 2, and characterized in that said means for providing variable thermal coupling comprises a body of hygroscopic material, whereby the quantity of heat transferred is a function of the moisture content of said material as absorbed from the moving air.

4. In air conditioning apparatus of the type including a refrigerant evaporator, a refrigerant condensing unit for said evaporator, means for circulating air to be conditioned over said evaporator, and a thermostat for controlling cyclic energization and deenergization of said condensing unit, said thermostat including a sensing element disposed in the stream of circulating air, the improvement comprising means responsive to changes in the relative humidity of the circulating air to vary the heat transferred between such air and said sensing element, said means including a body of thermally conductive material extending from a region downstream of said cooling coil to a region upstream thereof, into thermal exchange relation with said sensing element, and means including a hygroscopic material thermally coupling air upstream of said evaporator with said sensing element, the thermal coupling afforded by the recited material being a function of the moisture content of the circulating air.

5. In apparatus of the type set out in claim 4, and further characterized by the inclusion of movable shield means selectively positionable to vary the quantity of air flowing over said sensing element.

6. In combination, a thermostat including a sensing element, means for moving air over said sensing element, means for controlling the temperature and relative humidity of such air in accordance with temperatures sensed by said sensing element, means responsive to changes in relative humidity of said air for varying the heat transferred between said air and said sensing element, and means for modifying the quantity of air flow over said sensing element.

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WILLIAM J. WYE, Primary Examiner

U.S. Cl. X.R.

62—209, 262; 165—21; 136—44

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,492,833 Dated February 3, 1970

Inventor(s) KENNETH E. MARSTELLER

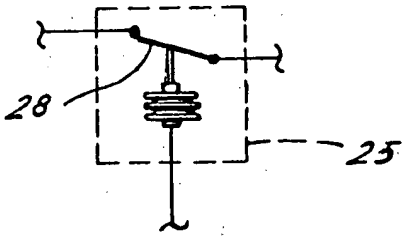
It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 43, "rom" should read -- room -- .

Column 3, line 27, "store a portion of the evaporator coil 16 to intercept" should be deleted.

Column 3, line 56, a period (.) should appear after "humidity", and "thus" should read -- Thus -- .

In the drawings, Sheet 2, Figure 3, the open contact of switch 28 of thermostat 25 should be moved from its illustrated position to a position above the switch 28, as shown in the following sketch.



SIGNED AND
SEALED
JUL 21 1970

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER,
Commissioner of Patents

USP 2,552,396

May 8, 1951 A. J. BRANDECKER 2,552,396

FORCED AIR COOLING APPARATUS

Filed May 18, 1949

Fig. 1

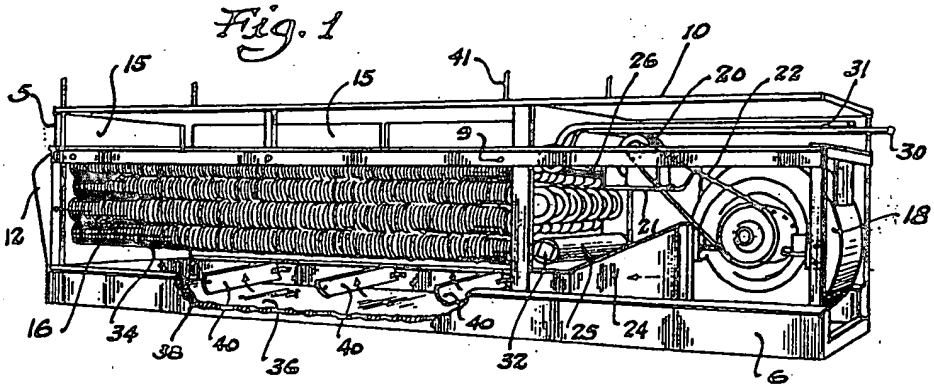


Fig. 2

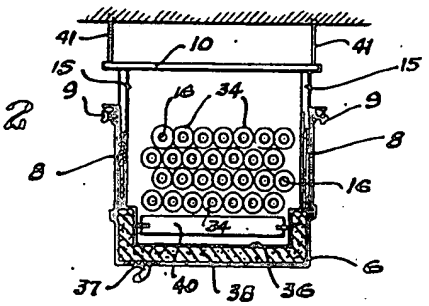
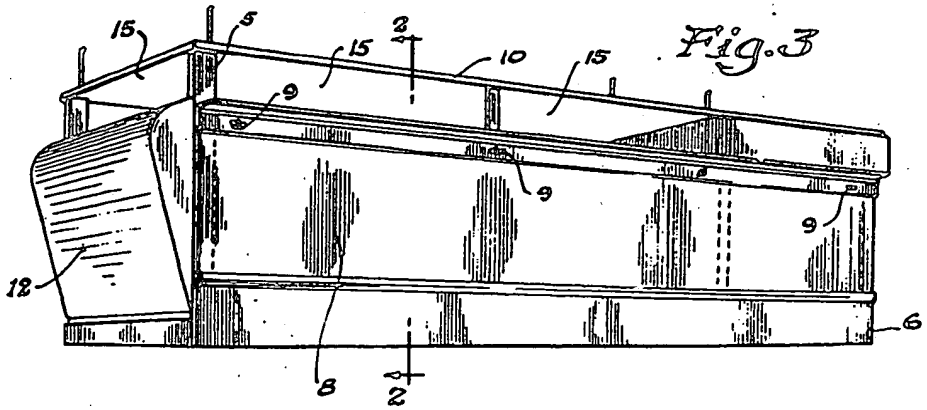


Fig. 3



Inventor

August J. Brandecker

Patented May 8, 1951

2,552,396

UNITED STATES PATENT OFFICE

2,552,396

FORCED AIR COOLING APPARATUS

August J. Brandecker, Chicago, Ill.

Application May 18, 1949, Serial No. 93,859

3 Claims. (Cl. 62—129)

1

This invention relates to refrigeration apparatus and has to do more particularly with a cooling unit for chilling the air in the space surrounding perishable food products and the like.

In the manufacture of fresh foods, such as meats, dairy and poultry products, and fruits and vegetables, it is necessary to chill the products and maintain them during storage at low temperatures in order to retard growth of bacteria therein and spoilage. The chilling of the products is usually performed by refrigerating the air which surrounds and contacts the materials.

A common method heretofore used in refrigerating the air in coolers and cold storage rooms is to circulate a refrigerating medium, such as cold salt brine or ammonia, through bare metal coils which transfer the cold to the surrounding air. This method has many disadvantages. For example, close control of temperature is difficult because there is slow circulation of the air and dead spots develop. Also, there is undesirable dehydration and shrinkage of the product due to a drop in humidity of the air as it is cooled. Thus, the air contacting the coils is overchilled and the water precipitated therefrom, and then moisture is extracted from the product by the dry air. Furthermore, the moisture collects on the cooling coils, causing drippage and eventually causing the accumulation of ice on the pipes which reduces their cooling efficiency.

An object of the present invention is to provide a simple and efficient space cooling unit which will eliminate the difficulties inherent in the prior art space coolers.

Another object of the invention is to provide a space cooler which will reduce shrinkage of the product.

A further object of the invention is to provide a space cooler which will give close temperature control and reduce chilling time.

Another object of the invention is to provide a space cooling unit which produces improved conditions of air circulation and air humidity.

Also, an object of the invention is to devise a space cooler which reduces drippage and which eliminates messy drip pans.

A still further object of the invention is to construct a space cooler which is easily cleaned and provides ready access to working parts.

The invention will be more clearly understood from the following description read in connection with the accompanying drawing which illustrates diagrammatically one form of construction of the apparatus.

Figure 1 is a side view of the apparatus with a panel removed showing the working parts

2

Figure 2 is a sectional elevation along the line 2—2 of Figure 3.

Figure 3 is a view in perspective of the left end and right side of the complete unit.

Referring to the drawings, the cooling unit is housed in a rectangular body comprising a frame designated generally by the numeral 5. The lower portion of the frame is covered with a bottom 6. Panels 8 are attached to the frame on each side by thumb screws 9. The top of the frame is covered by a plate 10. The left end of the frame is closed by a curved end member 12 which is bulged outwardly to permit room for the return bends of the cooling coils. A plurality of ports 15 is provided in the upper portions of the sides and the left end. Except for the ports 15 and the open right end, the frame is completely enclosed, as shown in Figures 2 and 3.

The working parts enclosed within the housing comprise a series of cooling coils 16, a blower 18, and a motor 20 which is suspended from the upper portion of the frame by a supporting means 21. The blower is connected to the motor by a belt 22. A duct 24 provides air communication between the blower and the space surrounding the coils 16. The duct 24 is adapted to discharge the air beneath the coils 16. The coils are supplied with a suitable refrigerant by an inlet pipe 30 and an outlet pipe 31 which connect with headers 25 and 26, respectively. The headers are provided with plugs 32 for cleaning out sediment collecting in the coils. In order to increase the efficiency of the coils 16, they are equipped with fins 34. The fins are preferably in the form of a continuous metal ribbon spirally wound on the tubes thereby forming a positive metal contact between the fin and the tube surface. Corrugations at the base of the fins afford large metal-to-metal contact and provide permanent bonding to the tube. This type of structure is highly efficient and increases the effective heat transfer surface.

As shown in Figures 1 and 2, a pan 36 is located in the lower portion of the unit beneath the coils 16. A drain pipe 37 is connected with the bottom of the pan to drain condensate therefrom. Insulation 38 is packed between the pan 36 and the bottom 6 to prevent chilling of the bottom 6 by the condensate and to avoid condensation and drippage of moisture from the bottom. A plurality of baffles or ribs 40, preferably curved in shape, is positioned in spaced relation over the pan 36 to deflect the air passing thereover upwardly around the coils 16.

The cooling unit herein described may be lo-

as, for example, any desired height on a wall or to the ceiling of the room. The unit is preferably suspended from the ceiling by means of the bolts or hooks 41.

In operation the cooling unit may be suspended a suitable distance below the ceiling at one end of the room to be cooled. The inlet and outlet pipes 30 and 31 are connected to an ammonia compression system. The liquid ammonia is discharged through the pipe 30 into the coils 16 wherein it expands and absorbs heat from the air surrounding the coils thereby causing cooling. The vaporized and warmed ammonia gas is drawn from the coils through the suction line 31 and cooled and compresed into liquid form for reuse. Air is drawn from the room through the right end of the unit by the blower and discharged through the duct 24. The air is deflected by the baffles 40 upwardly over the coils where it is cooled. The chilled air is then discharged through the ports 15 into the room.

The cooler of the present invention has the advantage that it occupies little space and can be located at a convenient out-of-the-way place in the room. The insulation in the bottom eliminates condensation on and drippage from the outside of the bottom. The detachable panels 8 are easily removed so that the unit may be readily cleaned. The circulation of the air through the unit enables close temperature control and avoids dead air spaces in the room. Also, the circulating air causes uniform cooling and avoids local over chilling. The humidity of the air is relatively high at all times and dehydration and shrinkage of the product are substantially reduced.

Obviously, many modifications and variations of the invention as hereinbefore set forth may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. In a cooling unit of the type adapted to be suspended from the ceiling of a refrigeration chamber and composed of a rectangular housing containing a refrigerating unit disposed toward one end of said housing and a blower disposed toward the other end and means for conducting air from the blower end under said refrigerating unit and upwardly thereover, the combination of longitudinally spaced deflectors under said refrigerating unit to distribute and to deflect the air uniformly over said refrigerating unit, a drip pan under said deflectors, said drip pan spaced above the floor of the housing, and insulation between the drip pan and said floor to prevent cooling of the floor by drip water.

2. In a cooling unit of the type adapted to be suspended from the ceiling of a refrigeration chamber and composed of a frame containing an elongated refrigerating unit occupying the major portion of one end of the frame and a blower toward the other end and means for conducting air from the blower end under said refrigerating unit, the combination of removable side walls on said frame, a top on said frame which is spaced above said side walls to provide ports for discharging cool air into said chamber, a bottom secured to the lower portion of said frame, baffles longitudinally spaced under said refrigerating unit to deflect upward and to distribute uniformly over the refrigerating unit air from said blower, a drip pan under said refrigerating unit and under said baffles, said drip pan being spaced above the bottom, and insulation between the drip pan and said bottom to prevent cooling of the bottom by drip water and the formation of condensate on the exterior of said bottom.

3. In a cooling unit of the type adapted to be suspended from the ceiling of a chamber to be cooled, the combination of a rectangular housing having an opening at one end, a blower near said opening to draw air to be cooled through said opening, elongated cooling coils occupying the major portion of the housing and located toward the end opposite said blower, a duct to conduct air from the blower under said coils, a plurality of spaced baffles under said coils, said baffles having a curved structure to deflect the air uniformly and upwardly over said coils, ports under the top of said housing and above said coils to discharge cooled air into said chamber, a drip pan under said coils and under said baffles, said drip pan being spaced above the bottom of said housing, and insulation between the drip pan and said bottom to prevent cooling of the bottom by drip water and the formation of condensate on the exterior of said bottom.

AUGUST J. BRANDECKER.

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HEATER

Filed May 29, 1930

Fig. 1

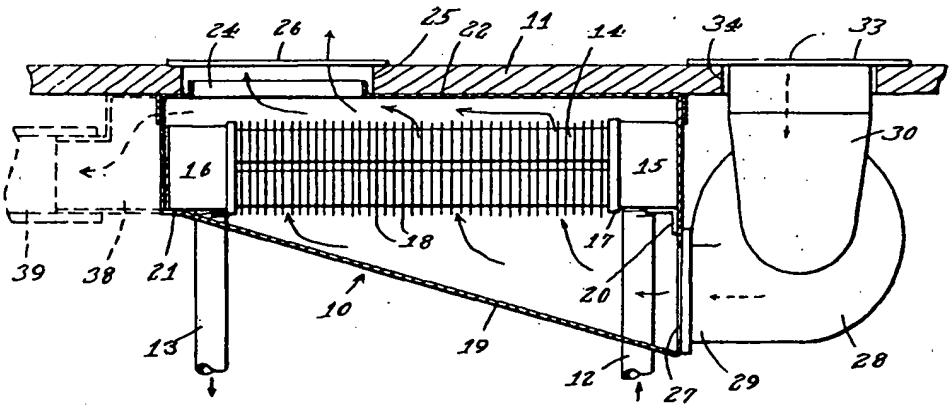
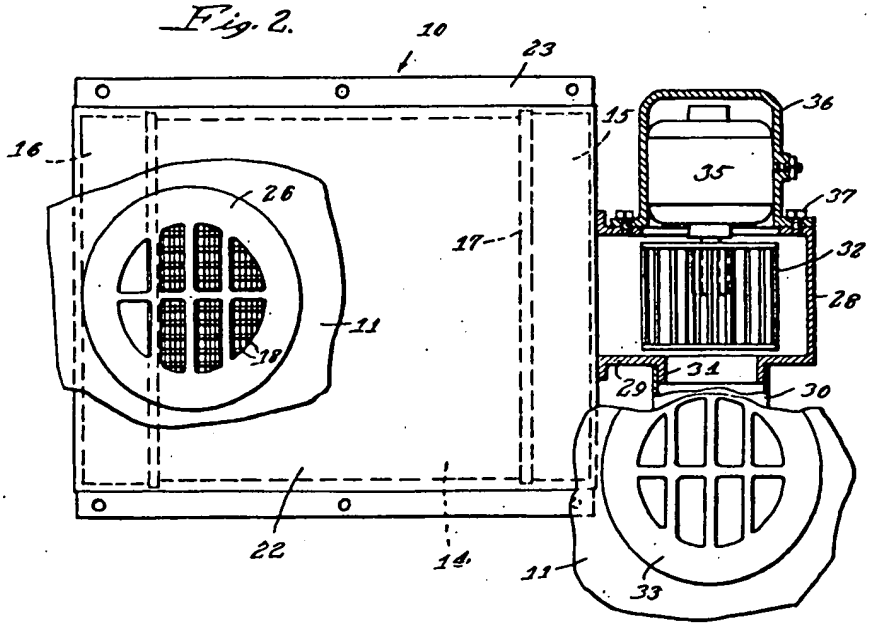


Fig. 2.



Inventor.

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By Wilson, Dowell, McCanna & Kelm

Attys.

Patented May 16, 1933 1,909,144

UNITED STATES PATENT OFFICE

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HEATER

Application filed May 29, 1930. Serial No. 456,960.

This invention relates to heaters for motor vehicles and has particular reference to one utilizing the heat in the fluid of the engine cooling system.

The principal object of my invention is to provide a heater designed and adapted for installation on any enclosing wall of the compartment to be heated.

Briefly stated, the heater of my invention comprises a casing containing a radiator core through which the heating fluid is circulated, the casing being open on one side of the radiator to a hot air register on the floor or other wall of the compartment to be heated, and on the other side to the casing or conduit of a suitable blower, whose intake is through a cold air register also on the floor or other wall of said compartment. The registers are spaced sufficiently to promote good circulation of air in the compartment and thus insure uniform heating, and the inlet and outlet openings of the casing are so disposed with reference to the radiator core that there is a very efficient heat exchange.

The invention is illustrated in the accompanying drawing in which

Figure 1 is a longitudinal section in a vertical or horizontal plane, depending on whether the part to which the heater is shown attached is the floor or a wall of the compartment to be heated;

Fig. 2 is a face view of Figure 1 showing the floor or wall broken away so as to disclose the heater unit and showing a portion of the latter in section.

The heater designated generally by the reference numeral 10 is shown mounted on a wall 11 of the compartment to be heated. The wall 11 may be the floor, ceiling, or any other enclosing wall of the body of a motor vehicle, or for that matter, a wall of any enclosure to be heated. For example, the suspension of the heater from the floor would be ideal for a rear seat installation, where some other heaters would be unsuited, and, of course, it is obvious that the arrangement would be suitable for front seat heating. Furthermore, heaters of this kind are suitable for use in motor busses, trucks, etc. Pipes 12 and 13 leading to and from the heater outside the compartment to be heated are suitably connected with the engine cooling system, the supply pipe 12 having connection preferably through a stop cock with a pipe tapped into the water jacket of the motor at a point where the motor attains the highest temperature and where it also gets hot immediately upon starting of the motor, namely, in the head of the motor, and the return pipe 13 having connection with a hose tapped into the lower outlet hose connection of the radiator of the car, between the latter and its water pump. From this much description it will be evident that the water or whatever cooling fluid is used, and which constitutes the heating medium for the heater, is supplied to the radiator core 14 of the heater from the motor through the supply pipe 12 and that it flows from the header 15 through the core to the header 16, and thence back to the motor through the return pipe 13. In warm weather the heater may be entirely shut off by simply closing the cock in the supply line. It is obvious that one or more of these heaters may be used in a given heating system, depending on the size of the compartment to be heated or upon whether more than one compartment is to be heated, or else one or more of these heaters may be provided in connection with a heater especially designed for, say, a front seat installation, the supply and return pipes 12 and 13 respectively, being suitably branched off from the same connections with the corresponding pipes of the other heater or heaters.

The radiator 14 may be of any suitable or preferred type but is herein illustrated as having what is known as a turbo-tube core consisting of two or more banks of parallel flat tubes connected at their opposite ends with the headers 15 and 16 through suitable header plates 17. Transverse radiating fins 18 are provided on the tubes to furnish the desired amount of radiation surface and they define between them a series of air passages through which the air is caused to flow in substantially parallel paths as will presently appear. A substantially

rectangular metal shell or casing 19 of right triangular cross-section, as appears in Figure 1, constitutes an enclosure for the radiator and has the same supported therein by its headers 15 and 16 in any suitable or preferred manner. I have shown a bracket 20 cooperating with the header 15 and arranged to be welded or otherwise suitably secured to the wall of the casing and a shoulder 21 formed on the inside of the casing to cooperate with the header 16. The bracket 20 and shoulder 21 support the radiator in spaced parallel relation to the cover 22, suitably of sheet metal. The cover is flanged to fit about the sides of the casing and is suitably secured thereto as by welding or soldering. Longitudinal supporting brackets 23 are provided at opposite sides of the casing 19 and suitably welded or otherwise secured thereto to serve as a means of supporting the heater on the wall 11, holes being provided in said brackets as shown in Fig. 2 for the reception of screws or bolts. An outlet opening 24 is provided in the cover at one end of the casing defined by an upturned annular flange which projects into an opening 25 provided in the wall 11. A grating 26 covers the opening 25 and serves as the hot air register. If desired a screen may be provided under the grating 26, especially where the heater is installed under the floor, or wherever dirt is apt to get into the casing through the openings in the grating. Such a screen could be fastened in place on the wall 11 in the fastening of the grating. An inlet opening 27 is provided in the wall of the casing on the other side of the radiator and at the opposite end of the casing from the opening 24. Cold air to be heated is arranged to be supplied to the casing through the opening 27 in any suitable or preferred manner. I have shown the casing 28 of a blower having the discharge end 29 thereof directly abutting and attached to the wall of the casing 21 over the opening 27, although it will be evident that an intermediate conduit might be provided between the casing 28, and the casing 21. The casing 28 has one end of an elbow 30 fitting over a neck 31 provided on one side thereof substantially concentric with the rotary impeller or fan 32 of the blower disposed in the casing as shown in Fig. 2. The other end of the elbow fits on a similar neck provided on a grating 33 mounted over an opening 34 provided in the wall 11 and arranged to serve as a cold air register. Here again a screen may be provided under the grating 33 if desired. The impeller 32 is of the squirrel cage type with the blades thereof mounted substantially parallel with one another in circumferentially spaced relation, and is mounted on the armature shaft of an electric motor 35 disposed in a housing 36 fastened on the other side of the casing 28 opposite the neck 31, as by means of bolts 37.

In operation, the cold air is drawn in through the cold air register and delivered through the elbow 30 to the center of the impeller 32 and discharged tangentially from the impeller through the inlet opening 27 into the casing 19, substantially as indicated by the arrows in Figure 1. The air passes through the radiator core between the fins 18 in substantially parallel paths and, of course, abstracts heat therefrom. The hot air is discharged from the casing through the opening 24 and into the compartment through the hot air register. The fact that the outlet for the hot air is at the opposite end of the casing from the cold air inlet insures exposure of the entire radiator, that is, not only the full length of the core but the headers as well, for efficient heat exchange with the air passing through the casing. By virtue of the arrangement illustrated it is obvious that the size of the inlet and outlet openings imposes no restriction whatever on the size of the heating element that can be employed, and consequently very effective heating can be provided for by simply using the proper sized heating element. Furthermore, the fact that the cold air register is spaced appreciably from the hot air register avoids any likelihood of short circuiting of the hot air immediately upon discharge back to the cold air register, and insures good circulation of air in the compartment to be heated and uniform heating thereof. If desired, the hot air need not be discharged from the casing directly into the compartment to be heated. For example, an outlet elbow or header 38 may be provided on the casing 19 as indicated in dotted lines in Figure 1, having a conduit 39 communicating therewith and leading to any point where the hot air is to be discharged.

It is believed the foregoing description conveys a clear understanding of my invention and all of its objects and advantages. Certain variations of the construction and arrangement have been indicated and it is apparent that still other changes may occur to those skilled in this art as a result of this disclosure. The appended claims have been drawn with a view to covering all legitimate modifications and adaptations.

I claim:

1. In a heater, the combination of a casing, a radiator comprising headers and a core therebetween for the passage therethrough of heating fluid from one header to the other, said radiator being disposed entirely within said casing with the one header thereof at one side wall and the other header at the opposite side wall whereby to separate one chamber in said casing on one side of the radiator from another chamber

in said casing on the other side thereof, fins on the core to transfer heat to the air passing the same, the said fins serving also to direct the air in its passage through the core in a predetermined manner so as to have air contacting all portions of the core and the adjacent headers substantially uniformly, air in passing from one chamber to the other being arranged to pass through the core and in heat transferring relation with the headers whereby to abstract heat therefrom, means for supplying air to be heated to said casing at one end of one of said chambers, and means for discharging heated air from said casing from the other end of the other chamber.

2. In a heater of the character described, the combination with an enclosing wall of a compartment to be heated, the same having a warm air opening and a cold air opening in spaced relation to one another for the circulation and recirculation of air in the compartment, of a casing mounted outside the compartment on said wall having an opening in the wall thereof at one end of the casing communicating with the warm air opening, a heating element disposed endwise in said casing, the cross-sectional area of the last mentioned opening being only a fraction of the cross-sectional area of the heating element and the latter being spaced from said opening to permit the passage of air from remote portions thereof in said casing to said opening, the said heating element being also spaced from the opposite wall of said casing to provide a chamber for the passage of air therebetween, and means having communication with the aforesaid cold air opening for supplying air to be heated from the compartment to the last mentioned chamber at the end of the casing opposite the warm air outlet opening.

3. In a heater, the combination of a casing of elongated form arranged to be supported on the outside of a wall of an enclosure to be heated, a heating element of elongated form disposed lengthwise in said casing and dividing the same into two chambers for incoming cold air and outgoing warm air, the air in passing from one chamber to the other being caused to traverse the heating element and abstract heat therefrom, a blower casing supported on one end of said casing by means of the discharge neck portion thereof for supplying cold air to the casing at one end of the cold air inlet chamber, there being means for delivering the warm air from the casing from the other end of the warm air outlet chamber, a centrifugal type blower fan in the blower casing, and means for supplying cold air to the side of the blower casing substantially centrally of said fan.

4. In a heating system of the character described, the combination with an enclosing wall of the compartment to be heated, of an elongated heater casing mounted on said wall outside the compartment, an elongated heating element disposed lengthwise in said casing and dividing the same into two chambers, one for incoming cold air and the other for outgoing warm air, there being a warm air register for said compartment and said casing having a warm air outlet opening at one end of the warm air outlet chamber for discharging warm air through said register, a centrifugal type blower fan, a casing therefor mounted on the other end of the heater casing and having a substantially tangential discharge opening communicating with the end of the cold air inlet chamber opposite the warm air outlet opening, there being a cold air register for said compartment spaced from the warm air register, an elbow communicating with the side of the blower casing substantially centrally of the fan therein and having communication with the cold air register, and means for driving the fan.

5. In a heating system of the character described, the combination with an enclosing wall of the compartment to be heated, of an elongated heater casing mounted on said wall outside the compartment, an elongated heating element disposed lengthwise in said casing and dividing the same into two chambers, one for incoming cold air and the other for outgoing warm air, there being a warm air register for said compartment and said casing having a warm air outlet opening at one end of the warm air outlet chamber for discharging warm air through said register, a centrifugal type blower fan, a casing therefor mounted on the other end of the heater casing and having a substantially tangential discharge opening communicating with the end of the cold air inlet chamber opposite the warm air outlet opening, there being a cold air register for said compartment spaced from the warm air register, an elbow communicating with the side of the blower casing substantially centrally of the fan therein and having communication with the cold air register, an electric motor for driving the fan having the same mounted on the armature shaft thereof, and a housing for said motor mounted on the blower casing on the opposite side thereof from the cold air inlet opening.

6. In a heating system of the character described, the combination with the floor of the compartment to be heated, of an elongated heater casing mounted on said floor outside the compartment, an elongated heating element disposed lengthwise in said casing and dividing the same into two chambers, one for incoming cold air and the other for outgoing warm air, there being a warm air register for said compartment and said

casing having a warm air outlet opening at one end of the warm air outlet chamber for discharging warm air through said register, a centrifugal type blower fan, a casing therefor mounted on the other end of the heater casing and having a substantially tangential discharge opening communicating with the end of the cold air inlet chamber opposite the warm air outlet opening, there being a cold air register for said compartment spaced from the warm air register, an elbow communicating with the side of the blower casing substantially centrally of the fan therein and having communication with the cold air register, and means for driving the fan.

7. In a heating system of the character described, the combination with the floor of the compartment to be heated, of an elongated heater casing mounted on said floor outside the compartment, an elongated heating element disposed lengthwise in said casing and dividing the same into two chambers, one for incoming cold air and the other for outgoing warm air, there being a warm air register for said compartment and said casing having a warm air outlet opening at one end of the warm air outlet chamber for discharging warm air through said register, a centrifugal type blower fan, a casing therefor mounted on the other end of the heater casing and having a substantially tangential discharge opening communicating with the end of the cold air inlet chamber opposite the warm air outlet opening, there being a cold air register for said compartment spaced from the warm air register, an elbow communicating with the side of the blower casing substantially centrally of the fan therein and having communication with the cold air register, an electric motor for driving the fan having the same mounted on the armature shaft thereof, and a housing for said motor mounted on the blower casing on the opposite side thereof from the cold air inlet opening.

8. In a heating system of the character described, the combination with an enclosing wall of the compartment to be heated, of an elongated heater casing mounted on the wall outside said compartment, an elongated radiator disposed length-wise in said casing and dividing the same into two chambers, one for incoming cold air and the other for outgoing warm air, said radiator comprising headers at opposite ends and a core therebetween, there being a warm air register for said compartment and said casing having a warm air outlet opening at one end of the warm air outlet chamber for discharging warm air through said register, a centrifugal type blower fan, a casing therefor mounted on the other end of the heater casing and having a substantially tangential discharge opening communicating with the end of the cold air inlet chamber opposite the warm air outlet opening, fins on the radiator core in transverse relation to the direction of travel of the air in the casing in going from the cold air inlet to the warm air outlet, said fins serving to transfer heat to the air passing therebetween and serving also to direct the air in its passage through the core in a predetermined manner so as to have the air contacting all portions of the core and the adjacent headers substantially uniformly, there being a cold air register for said compartment spaced from the warm air register, an elbow communicating with the side of the blower casing substantially centrally of the fan therein and having communication with the cold air register, and means for driving the fan.

9. In a heating system of the character described, the combination with the floor of the compartment to be heated, of an elongated heater casing mounted on the floor outside said compartment, an elongated radiator disposed lengthwise in said casing and dividing the same into two chambers, one for incoming cold air and the other for outgoing warm air, said radiator comprising headers at opposite ends and a core therebetween, there being a warm air register for said compartment and said casing having a warm air outlet opening at one end of the warm air outlet chamber for discharging warm air through said register, a centrifugal type blower fan, a casing therefor mounted on the other end of the heater casing and having a substantially tangential discharge opening communicating with the end of the cold air inlet chamber opposite the warm air outlet opening, fins on the radiator core in transverse relation to the direction of travel of the air in the casing in going from the cold air inlet to the warm air outlet, said fins serving to transfer heat to the air passing therebetween and serving also to direct the air in its passage through the core in a predetermined manner so as to have the air contacting all portions of the core and the adjacent headers substantially uniformly, there being a cold air register for said compartment spaced from the warm air register, an elbow communicating with the side of the blower casing substantially centrally of the fan therein and having communication with the cold air register, and means for driving the fan.

In witness of the foregoing I affix my signature.

ALBERT H. BATES.

USP 3,000,192

Sept. 19, 1961 W. H. MULLIN ET AL 3,000,192

AIR CONDITIONING

Filed May 25, 1960

FIG. 1.

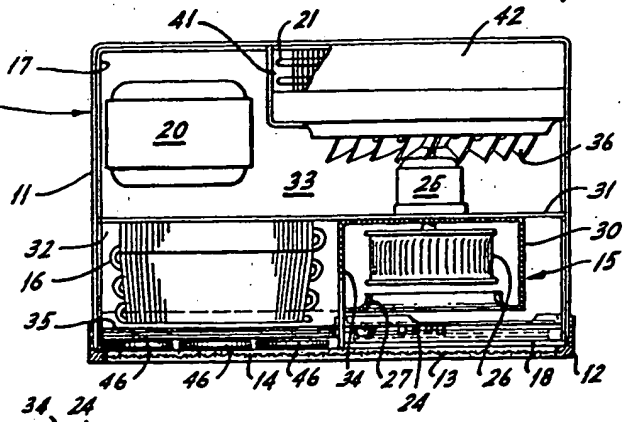
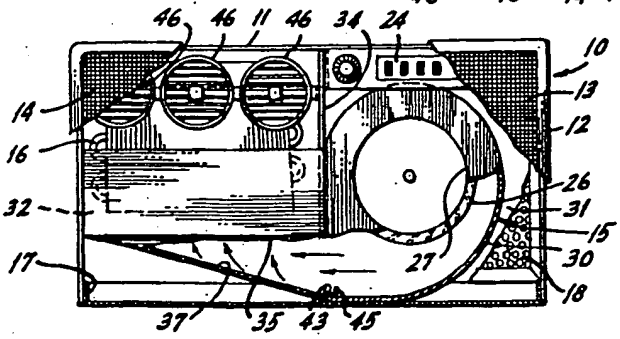


FIG. 2.



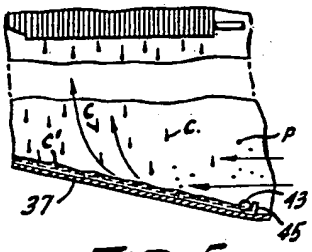


FIG. 5.

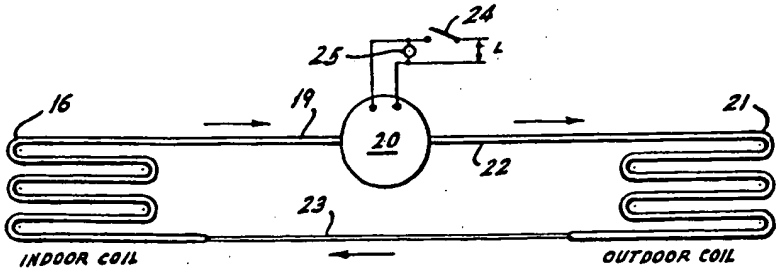


FIG. 4.

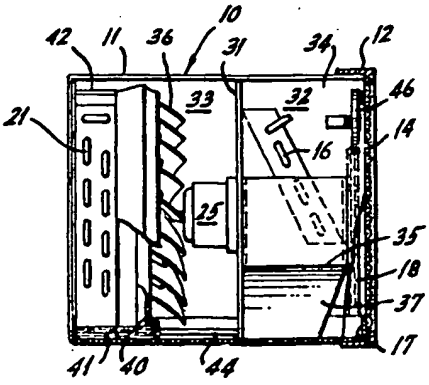


FIG. 3.

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United States Patent Office 3,000,192 Patented Sept. 19, 1961

3,000,192

AIR CONDITIONING

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Filed May 25, 1960, Ser. No. 31,652
7 Claims. (Cl. 62—285)

The present invention relates to air conditioning and is especially concerned with air conditioning apparatus of a compact and unitary type having novel means for collecting and disposing of particulate matter present in the circulating air.

It is a primary object of the invention to provide apparatus that achieves improved air cleaning.

It is a particular object of the invention to provide an air conditioner of the so-called "room cooler" type in which certain novel constructional featuers contribute to the compact nature thereof as well as result in a substantial improvement in the air treating function.

To the foregoing general ends, the invention contemplates the provision of air conditioning apparatus of the type including an air cooling heat exchange element or coil, and means for forcibly circulating air in heat exchange relation with said element, and in which the element has such novel disposition with respect to the air circulating means as both to minimize dimensions of the unit and to improve the air cleaning characteristics of the apparatus.

Advantageously, the air circulating means includes a sloping baffle for directing the air onto the cooling coil, said baffle being disposed and adapted to be wetted over substantially its entire air-directing area by condensate dripping from the coil.

It is a feature of the invention that the air is washed by a contact with the wetted area of the baffle, which area serves to entrap particulate matter impinging thereon. Inasmuch as this area slopes, the condensate runs off, carrying particulate matter therewith for subsequent disposal. Also, the air advantageously is washed by contact with the droplets of water falling through the air from the evaporator coil onto the baffle.

The manner in which the foregoing objects and advantages may best be achieved will be understood from a consideration of the accompanying drawing forming a part of this disclosure, and in which:

FIGURE 1 is a top plan view, with parts removed and other parts broken away, of air conditioning apparatus incorporating concepts of the present invention;

FIGURE 2 is a front elevational showing, partly in section and with parts broken away, of apparatus seen in FIGURE 1;

FIGURE 3 is an end view, with parts removed and in section, of the left hand portion of the apparatus as seen in FIGURE 2;

FIGURE 4 is a diagrammatic view illustrating the refrigerant circulating system; and

FIGURE 5 is a somewhat enlarged view, with parts broken away, of apparatus seen in FIGURE 2, and showing an operational feature of the invention.

Now making more detailed reference of to the drawing, and initially to FIGURES 1 to 3, the window mounted air conditioner 10 includes a cabinet or housing 11, preferably but not necessarily rectangular in configuration, having a base portion 17 and a conventional decorative panel 12, the latter comprising inlet and outlet room passage means for the air moving means to be hereinafter more fully described. The inlet includes grille 13 and a filter 18 disposed in the right hand region of panel 12 and in air flow communication with the inlet opening 15. The aforesaid outlet air passage means includes grille 14 disposed in air flow communication with an evaporator coil 16, hereinafter also referred to as the indoor coil. A plurality of independently rotatable louvers 46 are disposed between the evaporator coil 16 and outlet grille 14 and are adapted to provide selectivity of the direction of discharge air flow. Evaporator coil 16, preferably of the finned type, is part of the usual refrigerating system, shown diagrammatically in FIGURE 4 and including a motor compressor 20, condensing or outdoor coil 21, and associated conduits through which said motor compressor, condenser and evaporator coils are coupled in series flow circuit. These conduits include a line 22 through which refrigerant normally is delivered to outdoor coil 21 as the condenser, and a feed line 23 which, as shown, may advantageously comprise a continuously open restrictive connection through which liquified refrigerant is normally fed to the indoor coil 16 as the evaporator, for expansion therein. Refrigerant is withdrawn by the compressor from the evaporator through suction line 19 to complete the refrigerant flow circuit. Arrows applied to FIGURE 4 indicate the normal flow of refrigerant as occurs during the refrigerating cycle. The compressor is selectively energized through line L having in series therewith control switch means 24 (see also FIGURE 2).

Referring again to air moving means 15, a motor 25 is connected to line L (FIGURE 4) and rotatably supports the blower 26 adapted to cause circulation of air in heat exchange relation with evaporator coil 16. Blower 26 is housed within a scroll structure 30 disposed adjacent a partition 31 which divides cabinet 11 into an evaporator coil chamber 32 and a condensing coil chamber 33. The portion of cabinet 11 comprising chamber 32 is adapted to extend into a room or space to be air conditioned while chamber 33 of the cabinet, lying into the other side of partition 31, extends outwardly of the room preferably through a window opening thereof. The evaporator coil chamber 32 is subdivided by means of a partition 34, into a section having disposed therein the blower and scroll assembly 26, 30 and a section in which is disposed evaporator coil 16. The mouth portion 35 of the scroll 30 extends through partition 34 and into position to direct air against one face of evaporator coil 16 (FIGURES 2 and 3), as will be hereinafter more fully described in accordance with important features of the invention.

Condensing coil chamber 33 also has disposed therein motor compressor 20 and motor 25. A propeller type fan 36 is rotatably supported within chamber 33 by motor 25 to provide for drawing outside air into the chamber over the outdoor coil, and for discharging the spent air outwardly from the chamber over motor compressor 20.

The fan 36 includes a conventional condensate ring 40 which dips into a condensate sump 41 (FIGURES 1 and 3). In accordance with known practice, rotation of the fan causes condensate in sump 41 to be thrown by ring 40 onto baffle means 42 suitably disposed above the ring and extending, in a downward direction, over outdoor coil 21. Condensate impinging upon baffle means 42 flows on the latter and drips onto outdoor coil 21, to be evaporated therefrom in the course of the refrigerating cycle. Conduit means for directing the flow of condensate formed on the indoor coil to sump 41 comprises an opening 43 (FIGURE 2) formed in the mouth portion 35 of room blower scroll 30, from which opening 43 there extends a tube 44 terminating at sump 41 (FIGURE 3). Extending across the obliquely disposed bottom wall or baffle portion 37 of scroll mouth 35 is trough means

from evaporator coil 16 from running into the lowermost portion of scroll 30 and to insure outflow of condensate from baffle portion 37 through opening 43 for subsequent disposal in the manner above described.

In particular accordance with the invention, evaporator coil element 16 is so disposed as to extend generally angularly (see FIGURE 3) across an upper corner portion of housing 11, which portion comprises also the generally rectangular cross sectional area of the vertically extending evaporator chamber 32, as is best seen in FIGURES 1 and 3. The evaporator coil element 16 is generally planar in configuration and is positioned to slope in such manner that condensate drips from substantially the entire area of the evaporator and upon sloping baffle 37. The downward projection of the face portion of the evaporator is substantially equal to the upward projection of baffle 37 upon a plane normal to air moving therebetween. By the above described positioning of coil 16 vertical compactness of the unit also is enhanced.

Referring to FIGURES 2, 3 and 5, it will be seen that the baffle portion 37 of scroll mouth 35, while positioned to promote drainage of moisture as seen at C', derived from drops of condensate C falling thereon, is so positioned as abruptly to change the direction of the air driven from blower 26 (see arrows, FIGURES 2 and 5) and to cause the air abruptly to be directed upwardly and to impinge upon evaporator coil 16. Also, as mentioned, the baffle 37 is disposed generally in the area of downward projection of evaporator coil 16 and, by virtue of the above described cooperative positioning of baffle 37 and coil 16, condensate C dripping from the coil will drip substantially onto, and cover (as seen at C') the entire surface of baffle 37 and air being delivered from blower 26 is thus caused to flow in contact with the wetted upper surface of the baffle. Flow of air over the wetted surface results in cleaning of the air and in entrapment on the baffle of the relatively heavier particulate matter P impinging upon this surface of the baffle. In addition to the above filtering action, drops of water falling from the evaporator coil wash the air directed onto the coil. Initial coarse filtering of the air is provided by the filter 18 which is positioned between the blower 26 and the inlet air grill 13.

From the foregoing it is seen that the structure of the present invention, while affording a thorough filtering action, is characterized by simplicity and compactness. Importantly, formation of the film of moisture upon the surface of the inclined baffle is automatic, as is the disposal of the moisture and the particulate matter entrapped therein. Furthermore, it will be appreciated that due to the thorough filtering of air prior to its heat exchange contact with the evaporator coil surfaces, the latter remain substantially devoid of dust and dirt that would normally contribute to inefficient transfer of heat from the air thereto.

Still further, it will be appreciated that the same novel cooperative arrangement of the evaporator, inclined baffle, and blower provides movement of air through the evaporator chamber with a minimum of turbulence, thereby increasing the air flow rate and improving the efficiency of the air moving system. By virtue of the hereinabove described improved heat exchange and air moving functions, a relatively high degree of cooling capacity is achieved.

In summation, the invention provides an air conditioner of the room cooler type characterized by a high degree of compactness coupled with an increased capability for the treatment of air.

We claim:

1. An air conditioner comprising: a generally rectangular housing; an evaporator within said housing being so disposed as to extend angularly across an upper corner of said housing in such a manner that condensate drips from substantially the entire area of the evaporator; blower means within said housing and including baffle means so obliquely disposed beneath said evaporator as to direct air discharged from said blower means upwardly over said evaporator in heat exchange therewith, positioning of said baffle means further being such that condensate formed upon said evaporator and falling therefrom impinges upon and wets substantially the entire air directing surface of said baffle means, the wetted surface being effective to entrap particulate matter entrained in the air moved by said blower means.

2. An air conditioner according to claim 1, wherein said blower means comprises a centrifugal impeller and a scroll disposed thereabout, and said baffle means is formed integrally with said scroll and disposed adjacent the path of air discharge.

3. In an air conditioning unit, the combination comprising: a housing having air inlet and outlet openings communicating with a space to be cooled; an air filter element disposed and adapted to extend across said air inlet opening; blower means for drawing air through said inlet opening and forcing the same through said outlet opening; a cooling element disposed within said housing, at a level above said blower means, and in the path of air as it moves through said outlet opening, said cooling element being further disposed angularly as respects said housing and in such a manner that condensate drips from substantially the entire area of said cooling element; and baffle means so angularly disposed below said cooling element as to direct air from said blower upwardly over said element in high heat exchange therewith and adapted to be wetted by condensate formed at and dripping from said cooling element whereby particulate matter entrained in the moving air becomes entrapped in said condensate, angular disposition of said baffle means providing for continuous drainage of condensate and entrapped particulate matter therefrom.

4. In an air conditioner, the combination comprising: a housing; blower means including an air discharge port from which air is forced through said housing; a cooling coil within said housing, disposed at a level above said blower means air discharge port, and having a flat face portion so inclined as respects the said housing that condensate drips from substantially the entire area of the coil face portion; and baffle means disposed below said coil adjacent said blower means air discharge port and so inclined as to direct air discharged from said air discharge port upwardly over said coil in high heat exchange therewith, said baffle means further being positioned in such manner that its upward projection is substantially equal to the downward projection of the face portion of said cooling coil upon a plane normal to air moving therebetween, said baffle means thereby being positioned to be wetted by condensate formed at and dripping from said coil, particulate matter entrained in the moving air becoming entrapped in the condensate, the inclined disposition of said baffle means further providing for continuous drainage of condensate and entrapped particulate matter therefrom.

5. An air conditioner comprising: a housing; an evaporator within said housing, said evaporator comprising a planar coil element so inclined from the horizontal that condensate drips and falls from substantially the entire area of the evaporator element; and blower means within said housing and including baffle means disposed beneath said evaporator coil element and so inclined from the horizontal as to direct air discharged from said blower means upwardly over said evaporator coil element in heat exchange relation therewith, positioning of said baffle means further being such that condensate formed upon said evaporator coil element and falling therefrom impinges upon and wets substantially the entire air directing surface of said baffle means, the wetted surface being effective to entrap particulate matter entrained in the air being moved.

housing; cooling coil means within said housing and so inclined from the horizontal that condensate formed thereon falls therefrom substantially across the entire area of said coil means; and baffle means disposed below said coil means and so inclined from the horizontal as to direct air discharged from said blower means upwardly over said coil means in high heat exchange relation therewith and positioned to be wetted by condensate formed at and dripping from said coil means, whereby particulate matter entrained in the moving air becomes entrapped in said condensate, the inclined disposition of said baffle means providing for continuous drainage of condensate and entrapped particulate matter therefrom.

7. An air conditioner according to claim 6 and further including drain trough means cooperatively disposed with said baffle means whereby to drain condensate and washed particulate matter therefrom for disposal.

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